FIG.1

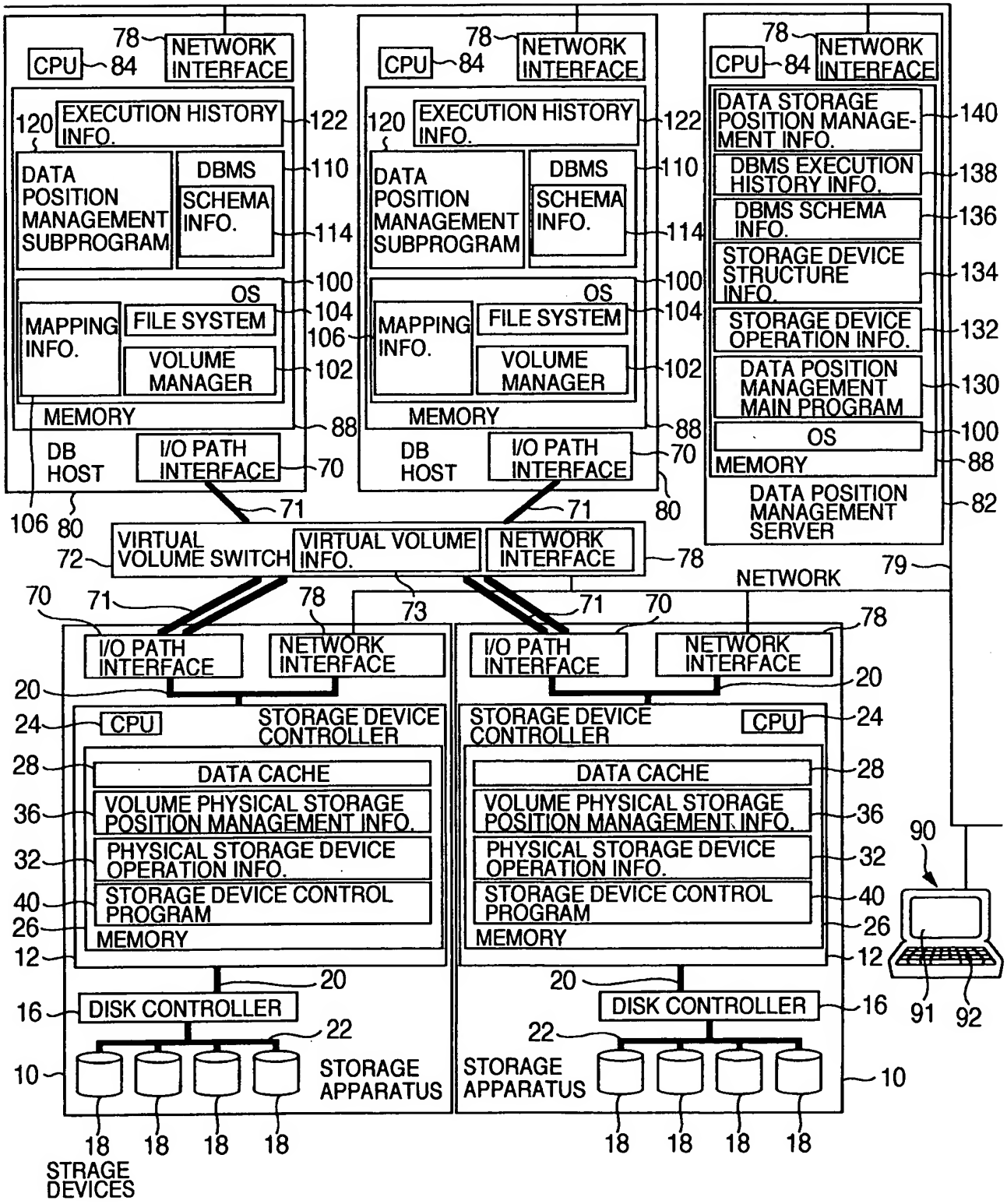

CPU
84
78
NETWORK INTERFACE
120
EXECUTION HISTORY INFO.
122
DATA POSITION MANAGEMENT SUBPROGRAM
DBMS
SCHEMA INFO.
110
114
OS
100
MAPPING INFO.
FILE SYSTEM
104
106
VOLUME MANAGER
102
MEMORY
88
DB HOST
I/O PATH INTERFACE
70
71
80
106
DATA STORAGE POSITION MANAGEMENT INFO.
140
DBMS EXECUTION HISTORY INFO.
138
DBMS SCHEMA INFO.
136
STORAGE DEVICE STRUCTURE INFO.
134
STORAGE DEVICE OPERATION INFO.
132
DATA POSITION MANAGEMENT MAIN PROGRAM
130
DATA POSITION MANAGEMENT SERVER
82
72
VIRTUAL VOLUME SWITCH
VIRTUAL VOLUME INFO.
73
NETWORK
79
STORAGE DEVICE CONTROLLER
24
DATA CACHE
28
VOLUME PHYSICAL STORAGE POSITION MANAGEMENT INFO.
36
PHYSICAL STORAGE DEVICE OPERATION INFO.
32
STORAGE DEVICE CONTROL PROGRAM
40
26
12
20
DISK CONTROLLER
16
22
STORAGE APPARATUS
10
18
STRAGE DEVICES
90
91
92

FIG.2

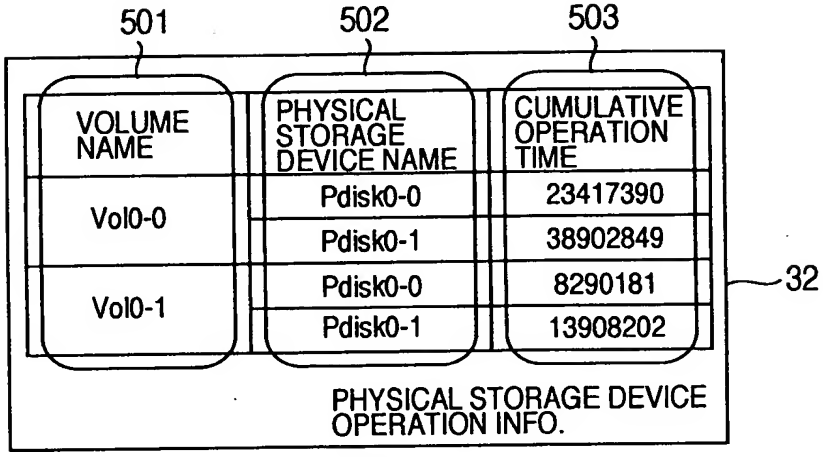

501
502
503
VOLUME NAME
PHYSICAL STORAGE DEVICE NAME
CUMULATIVE OPERATION TIME
Vol0-0
Pdisk0-0
23417390
Pdisk0-1
38902849
Vol0-1
Pdisk0-0
8290181
Pdisk0-1
13908202
32
PHYSICAL STORAGE DEVICE OPERATION INFO.

FIG.3

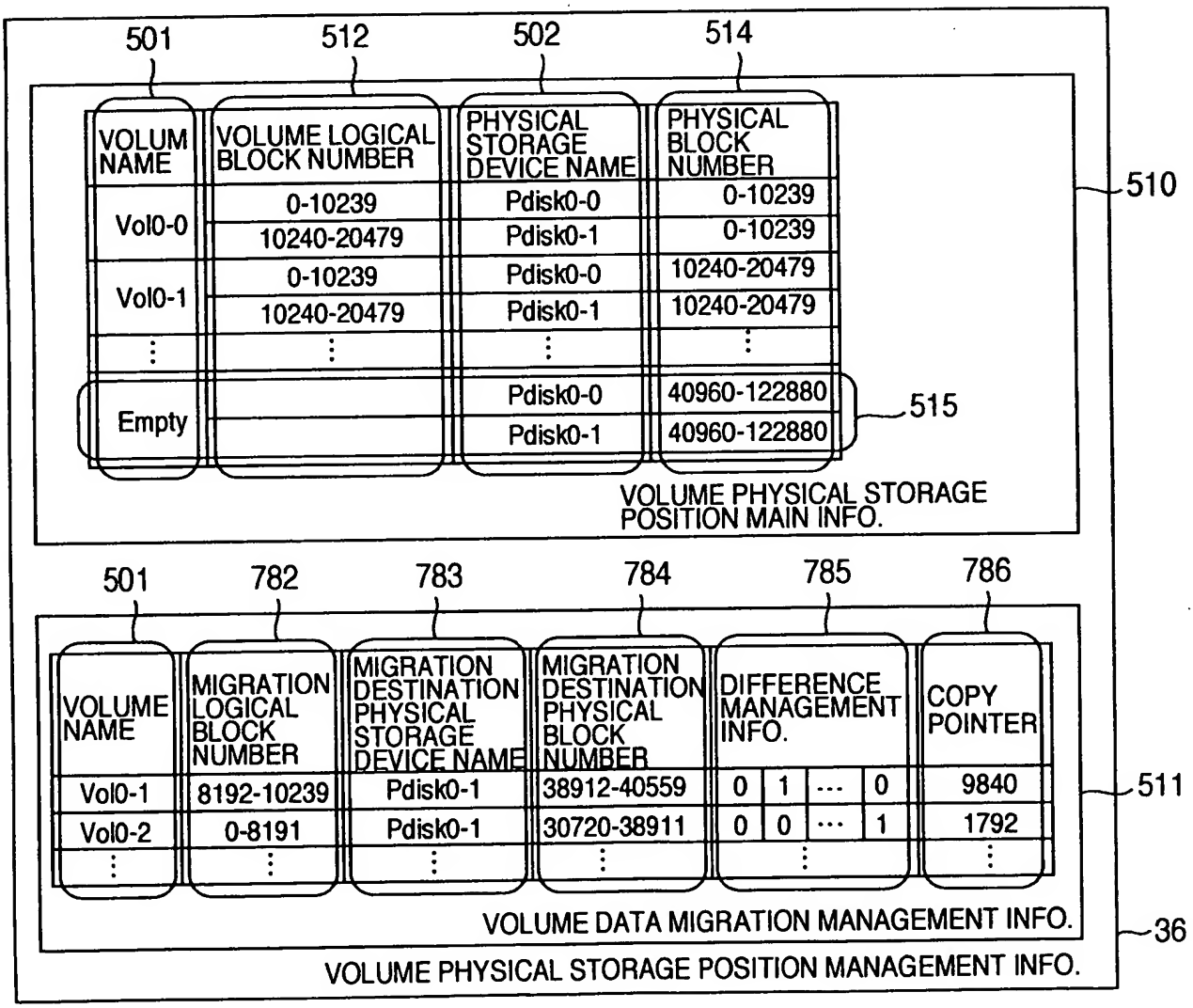

501
512
502
514
VOLUM NAME
VOLUME LOGICAL BLOCK NUMBER
PHYSICAL STORAGE DEVICE NAME
PHYSICAL BLOCK NUMBER
Vol0-0
0-10239
Pdisk0-0
0-10239
10240-20479
Pdisk0-1
0-10239
Vol0-1
0-10239
Pdisk0-0
10240-20479
10240-20479
Pdisk0-1
10240-20479
Empty
Pdisk0-0
40960-122880
Pdisk0-1
40960-122880
515
510
VOLUME PHYSICAL STORAGE POSITION MAIN INFO.
501
782
783
784
785
786
VOLUME NAME
MIGRATION LOGICAL BLOCK NUMBER
MIGRATION DESTINATION PHYSICAL STORAGE DEVICE NAME
MIGRATION DESTINATION PHYSICAL BLOCK NUMBER
DIFFERENCE MANAGEMENT INFO.
COPY POINTER
Vol0-1
8192-10239
Pdisk0-1
38912-40559
0 1 ... 0
9840
Vol0-2
0-8191
Pdisk0-1
30720-38911
0 0 ... 1
1792
511
VOLUME DATA MIGRATION MANAGEMENT INFO.
36
VOLUME PHYSICAL STORAGE POSITION MANAGEMENT INFO.

FIG.4

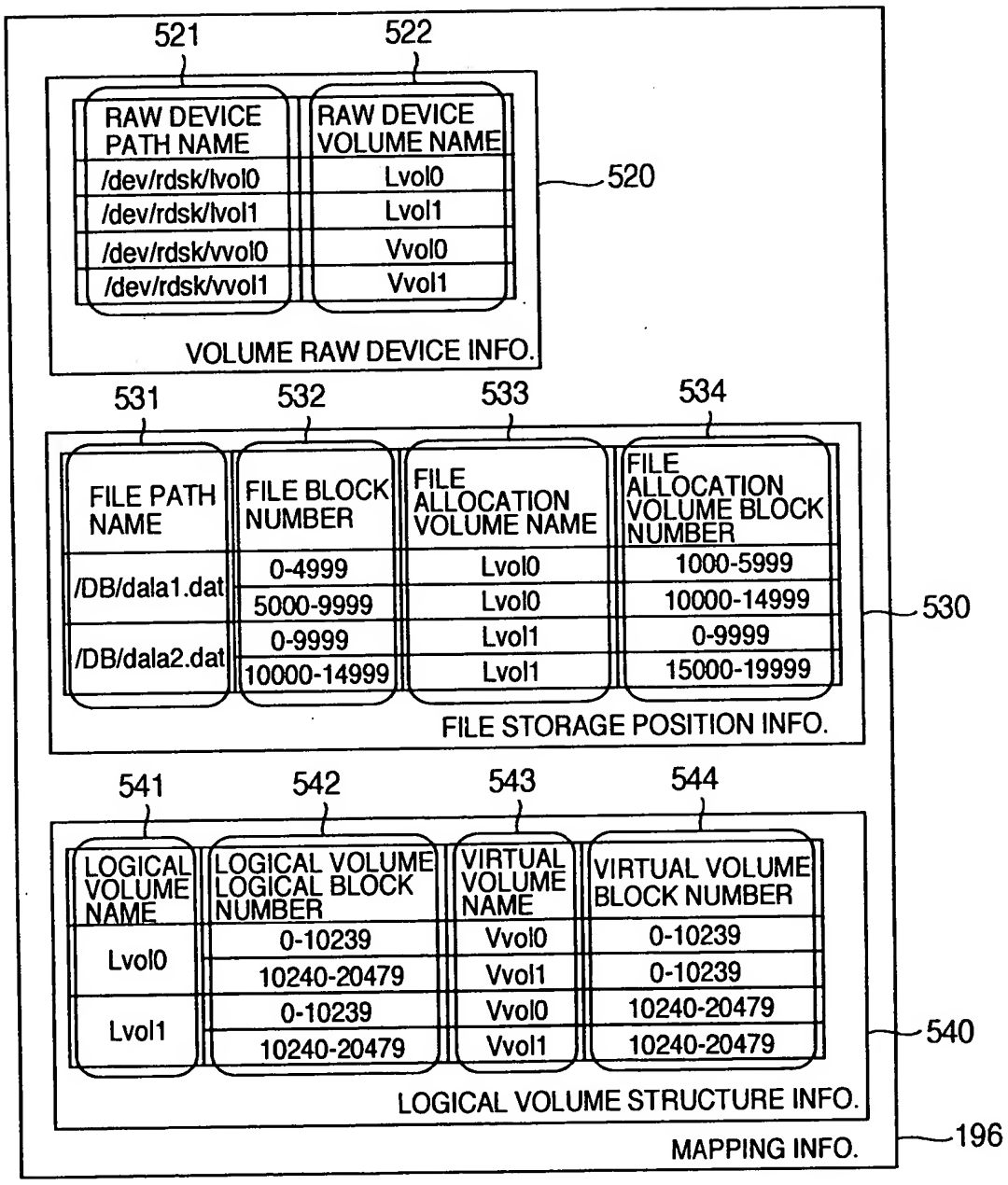

521
522
RAW DEVICE PATH NAME
RAW DEVICE VOLUME NAME
/dev/rdsk/lvol0
Lvol0
/dev/rdsk/lvol1
Lvol1
/dev/rdsk/vvol0
Vvol0
/dev/rdsk/vvol1
Vvol1
520
VOLUME RAW DEVICE INFO.
531
532
533
534
FILE PATH NAME
FILE BLOCK NUMBER
FILE ALLOCATION VOLUME NAME
FILE ALLOCATION VOLUME BLOCK NUMBER
/DB/dala1.dat
0-4999
Lvol0
1000-5999
5000-9999
Lvol0
10000-14999
/DB/dala2.dat
0-9999
Lvol1
0-9999
10000-14999
Lvol1
15000-19999
530
FILE STORAGE POSITION INFO.
541
542
543
544
LOGICAL VOLUME NAME
LOGICAL VOLUME LOGICAL BLOCK NUMBER
VIRTUAL VOLUME NAME
VIRTUAL VOLUME BLOCK NUMBER
Lvol0
0-10239
Vvol0
0-10239
10240-20479
Vvol1
0-10239
Lvol1
0-10239
Vvol0
10240-20479
10240-20479
Vvol1
10240-20479
540
LOGICAL VOLUME STRUCTURE INFO.
MAPPING INFO.
196

FIG.5

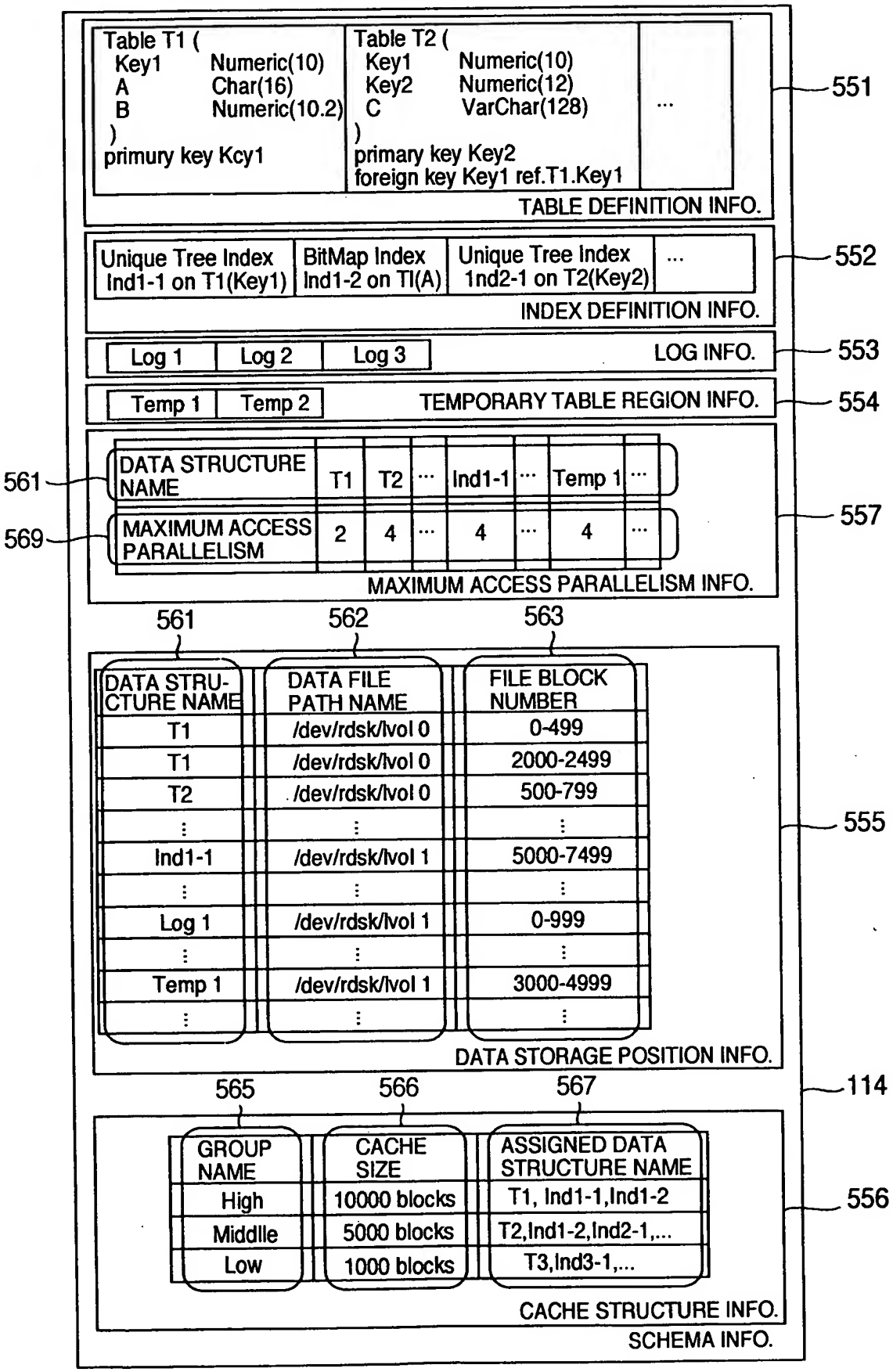


Table T1 (
Key1 Numeric(10)
A Char(16)
B Numeric(10.2)
)
primury key Kcy1
Table T2 (
Key1 Numeric(10)
Key2 Numeric(12)
C VarChar(128)
)
primary key Key2
foreign key Key1 ref.T1.Key1
...
TABLE DEFINITION INFO.
551
Unique Tree Index Ind1-1 on T1(Key1)
BitMap Index Ind1-2 on TI(A)
Unique Tree Index 1nd2-1 on T2(Key2)
...
INDEX DEFINITION INFO.
552
Log 1
Log 2
Log 3
LOG INFO.
553
Temp 1
Temp 2
TEMPORARY TABLE REGION INFO.
554
561
569
DATA STRUCTURE NAME
T1
T2
Ind1-1
Temp 1
MAXIMUM ACCESS PARALLELISM
2
4
4
4
MAXIMUM ACCESS PARALLELISM INFO.
557
561
562
563
DATA STRU-CTURE NAME
DATA FILE PATH NAME
FILE BLOCK NUMBER
T1 /dev/rdsk/lvol 0 0-499
T1 /dev/rdsk/lvol 0 2000-2499
T2 /dev/rdsk/lvol 0 500-799
Ind1-1 /dev/rdsk/lvol 1 5000-7499
Log 1 /dev/rdsk/lvol 1 0-999
Temp 1 /dev/rdsk/lvol 1 3000-4999
DATA STORAGE POSITION INFO.
555
565
566
567
GROUP NAME
CACHE SIZE
ASSIGNED DATA STRUCTURE NAME
High 10000 blocks T1, Ind1-1,Ind1-2
Middlle 5000 blocks T2,Ind1-2,Ind2-1,...
Low 1000 blocks T3,Ind3-1,...
CACHE STRUCTURE INFO.
556
SCHEMA INFO.
114

FIG.6

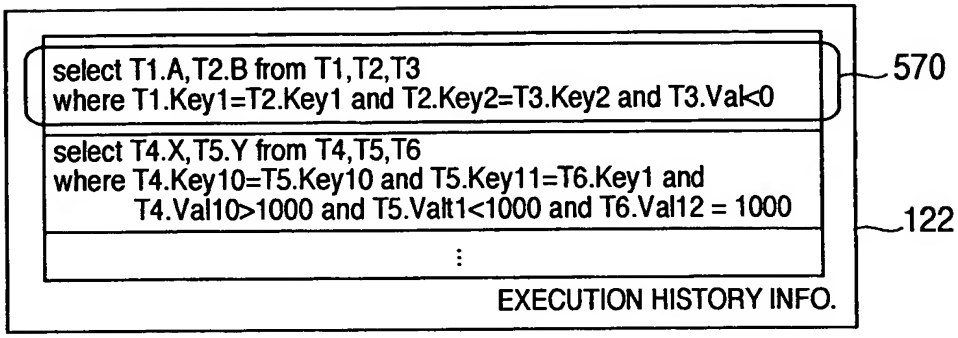

select T1.A,T2.B from T1,T2,T3
where T1.Key1=T2.Key1 and T2.Key2=T3.Key2 and T3.Val<0
select T4.X,T5.Y from T4,T5,T6
where T4.Key10=T5.Key10 and T5.Key11=T6.Key1 and
T4.Val10>1000 and T5.Valt1<1000 and T6.Val12 = 1000
570
122
EXECUTION HISTORY INFO.

FIG.7

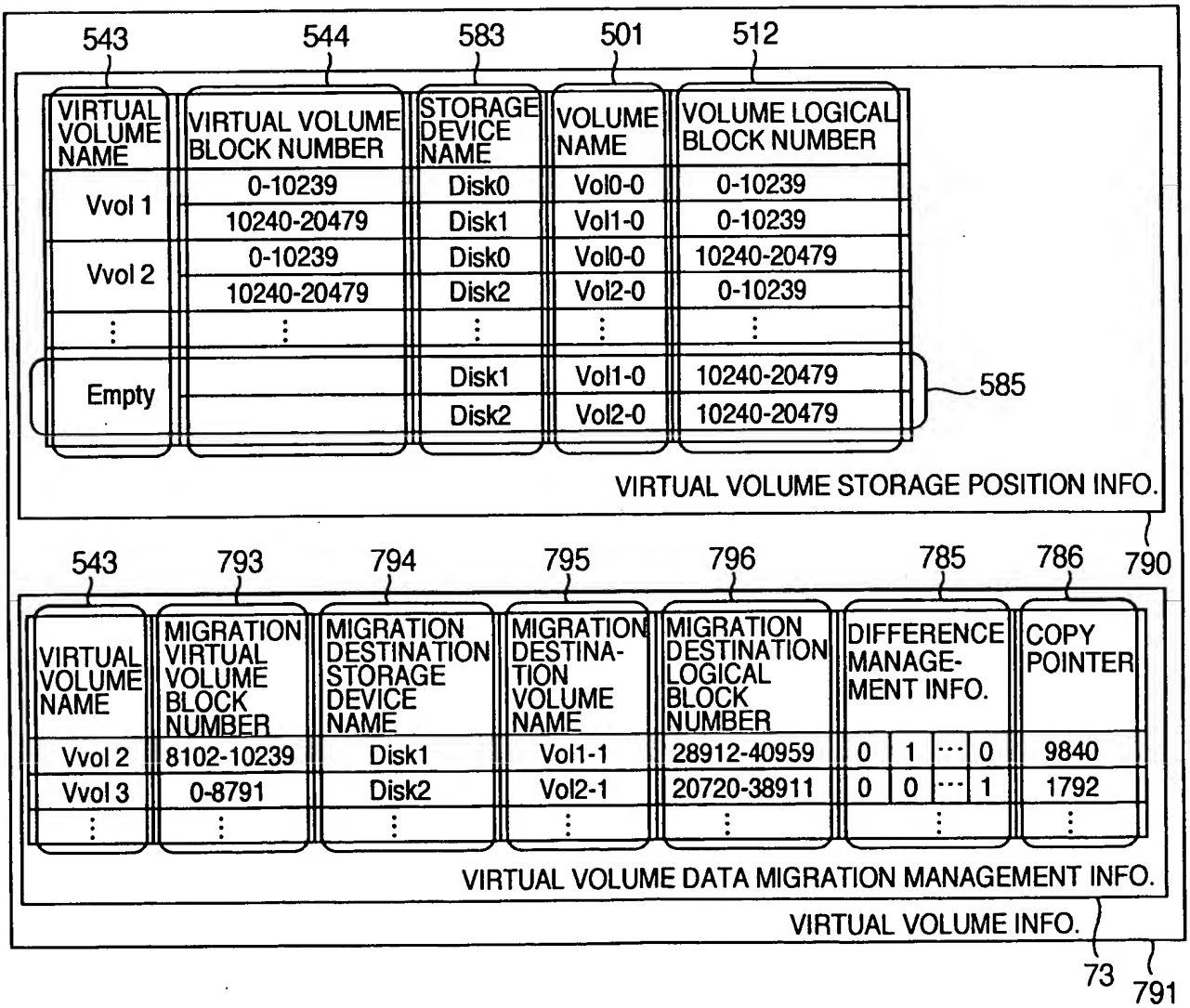

543
544
583
501
512
VIRTUAL VOLUME NAME
VIRTUAL VOLUME BLOCK NUMBER
STORAGE DEVICE NAME
VOLUME NAME
VOLUME LOGICAL BLOCK NUMBER
Vvol 1
0-10239
Disk0
Vol0-0
0-10239
10240-20479
Disk1
Vol1-0
0-10239
Vvol 2
0-10239
Disk0
Vol0-0
10240-20479
10240-20479
Disk2
Vol2-0
0-10239
Empty
Disk1
Vol1-0
10240-20479
Disk2
Vol2-0
10240-20479
585
VIRTUAL VOLUME STORAGE POSITION INFO.
790
543
793
794
795
796
785
786
VIRTUAL VOLUME NAME
MIGRATION VIRTUAL VOLUME BLOCK NUMBER
MIGRATION DESTINATION STORAGE DEVICE NAME
MIGRATION DESTINA-TION VOLUME NAME
MIGRATION DESTINATION LOGICAL BLOCK NUMBER
DIFFERENCE MANAGE-MENT INFO.
COPY POINTER
Vvol 2
8102-10239
Disk1
Vol1-1
28912-40959
0 1 ··· 0
9840
Vvol 3
0-8791
Disk2
Vol2-1
20720-38911
0 0 ··· 1
1792
VIRTUAL VOLUME DATA MIGRATION MANAGEMENT INFO.
VIRTUAL VOLUME INFO.
73
791

FIG.8

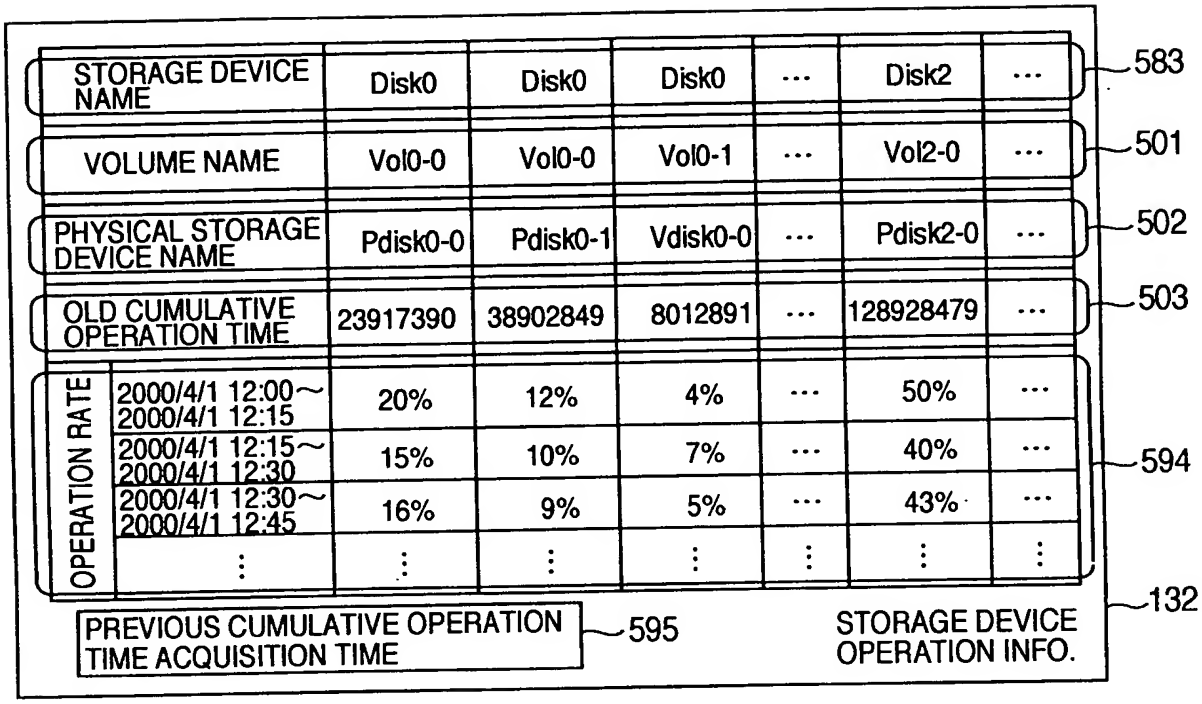

STORAGE DEVICE NAME
Disk0
Disk0
Disk0
Disk2
583
VOLUME NAME
Vol0-0
Vol0-0
Vol0-1
Vol2-0
501
PHYSICAL STORAGE DEVICE NAME
Pdisk0-0
Pdisk0-1
Vdisk0-0
Pdisk2-0
502
OLD CUMULATIVE OPERATION TIME
23917390
38902849
8012891
128928479
503
OPERATION RATE
2000/4/1 12:00～2000/4/1 12:15
20%
12%
4%
50%
2000/4/1 12:15～2000/4/1 12:30
15%
10%
7%
40%
2000/4/1 12:30～2000/4/1 12:45
16%
9%
5%
43%
594
PREVIOUS CUMULATIVE OPERATION TIME ACQUISITION TIME
595
STORAGE DEVICE OPERATION INFO.
132

FIG.9

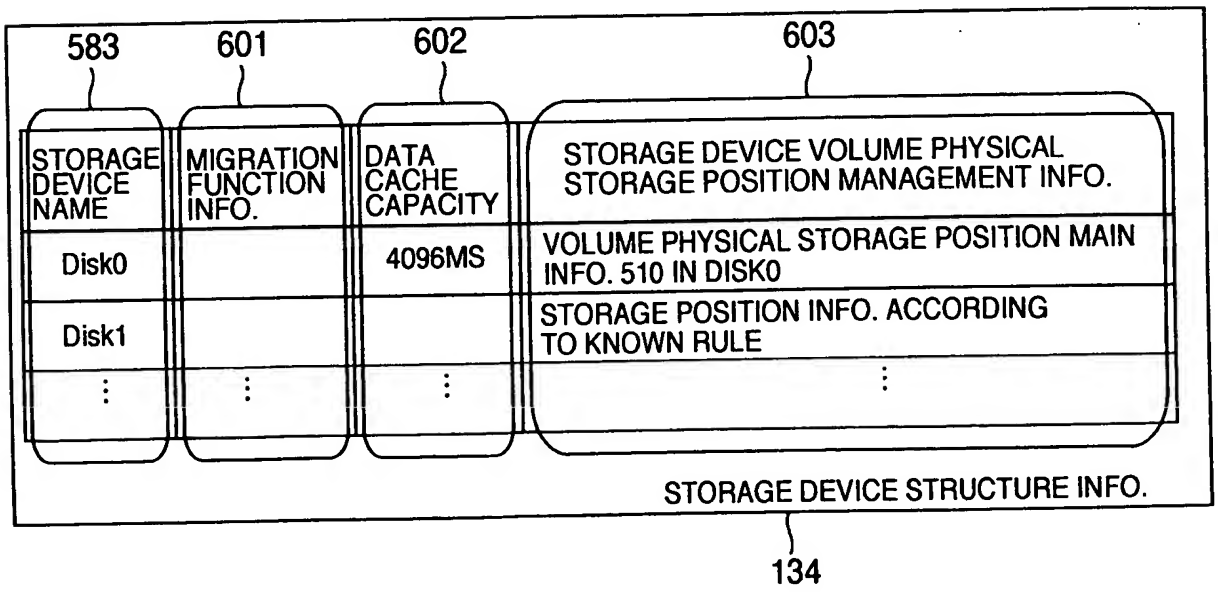

583
601
602
603
STORAGE DEVICE NAME
MIGRATION FUNCTION INFO.
DATA CACHE CAPACITY
STORAGE DEVICE VOLUME PHYSICAL STORAGE POSITION MANAGEMENT INFO.
Disk0
4096MS
VOLUME PHYSICAL STORAGE POSITION MAIN INFO. 510 IN DISK0
Disk1
STORAGE POSITION INFO. ACCORDING TO KNOWN RULE
STORAGE DEVICE STRUCTURE INFO.
134

FIG.10

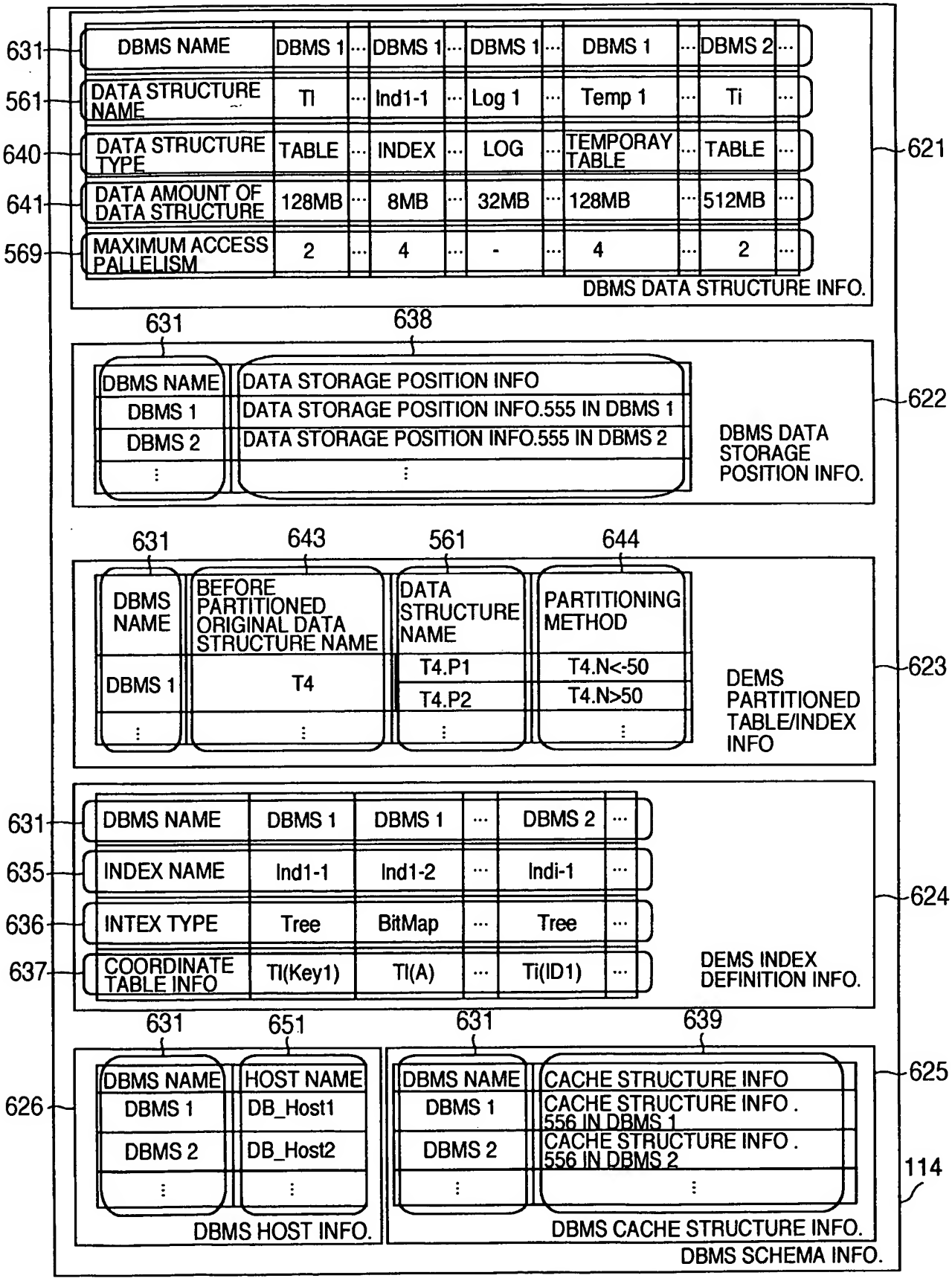

631
DBMS NAME
DBMS 1
DBMS 1
DBMS 1
DBMS 1
DBMS 2
561
DATA STRUCTURE NAME
TI
Ind1-1
Log 1
Temp 1
Ti
640
DATA STRUCTURE TYPE
TABLE
INDEX
LOG
TEMPORAY TABLE
TABLE
641
DATA AMOUNT OF DATA STRUCTURE
128MB
8MB
32MB
128MB
512MB
569
MAXIMUM ACCESS PALLELISM
2
4
-
4
2
621
DBMS DATA STRUCTURE INFO.
631
638
DBMS NAME
DATA STORAGE POSITION INFO
DBMS 1
DATA STORAGE POSITION INFO.555 IN DBMS 1
DBMS 2
DATA STORAGE POSITION INFO.555 IN DBMS 2
622
DBMS DATA STORAGE POSITION INFO.
631
643
561
644
DBMS NAME
BEFORE PARTITIONED ORIGINAL DATA STRUCTURE NAME
DATA STRUCTURE NAME
PARTITIONING METHOD
DBMS 1
T4
T4.P1
T4.N<-50
T4.P2
T4.N>50
623
DEMS PARTITIONED TABLE/INDEX INFO
631
DBMS NAME
DBMS 1
DBMS 1
DBMS 2
635
INDEX NAME
Ind1-1
Ind1-2
Indi-1
636
INTEX TYPE
Tree
BitMap
Tree
637
COORDINATE TABLE INFO
TI(Key1)
TI(A)
Ti(ID1)
624
DEMS INDEX DEFINITION INFO.
631
651
631
639
626
DBMS NAME
HOST NAME
DBMS 1
DB_Host1
DBMS 2
DB_Host2
DBMS HOST INFO.
DBMS NAME
CACHE STRUCTURE INFO
DBMS 1
CACHE STRUCTURE INFO . 556 IN DBMS 1
DBMS 2
CACHE STRUCTURE INFO . 556 IN DBMS 2
625
DBMS CACHE STRUCTURE INFO.
114
DBMS SCHEMA INFO.

FIG.11

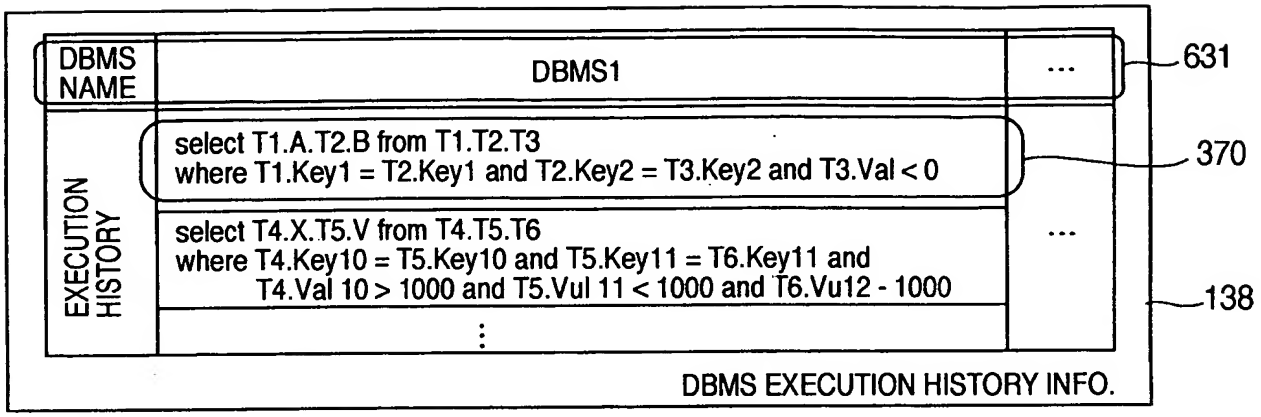

DBMS NAME
DBMS1
...
631
EXECUTION HISTORY
select T1.A.T2.B from T1.T2.T3
where T1.Key1 = T2.Key1 and T2.Key2 = T3.Key2 and T3.Val < 0
370
select T4.X.T5.V from T4.T5.T6
where T4.Key10 = T5.Key10 and T5.Key11 = T6.Key11 and
T4.Val 10 > 1000 and T5.Vul 11 < 1000 and T6.Vu12 - 1000
...
138
DBMS EXECUTION HISTORY INFO.

FIG.12

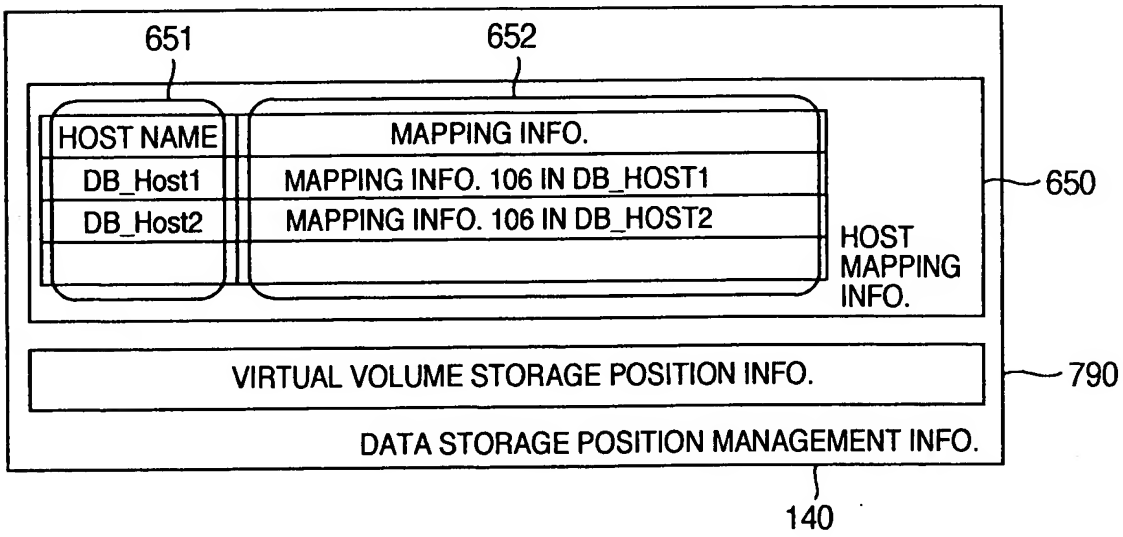

651
652
HOST NAME
MAPPING INFO.
DB_Host1
MAPPING INFO. 106 IN DB_HOST1
DB_Host2
MAPPING INFO. 106 IN DB_HOST2
HOST MAPPING INFO.
650
VIRTUAL VOLUME STORAGE POSITION INFO.
790
DATA STORAGE POSITION MANAGEMENT INFO.
140

FIG.13

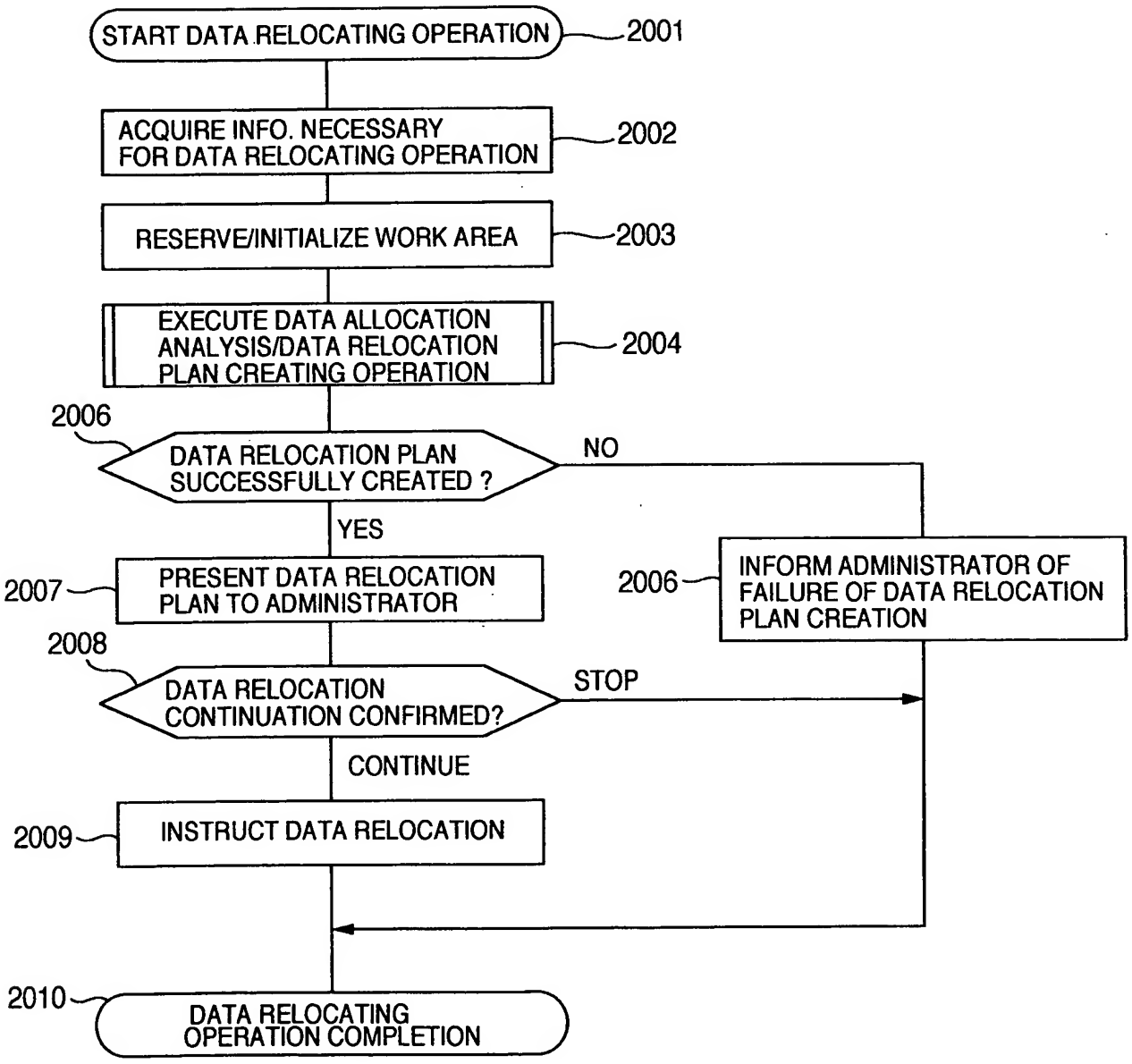

START DATA RELOCATING OPERATION
2001
ACQUIRE INFO. NECESSARY FOR DATA RELOCATING OPERATION
2002
RESERVE/INITIALIZE WORK AREA
2003
EXECUTE DATA ALLOCATION ANALYSIS/DATA RELOCATION PLAN CREATING OPERATION
2004
2006
DATA RELOCATION PLAN SUCCESSFULLY CREATED ?
NO
YES
2006
INFORM ADMINISTRATOR OF FAILURE OF DATA RELOCATION PLAN CREATION
2007
PRESENT DATA RELOCATION PLAN TO ADMINISTRATOR
2008
DATA RELOCATION CONTINUATION CONFIRMED?
STOP
CONTINUE
2009
INSTRUCT DATA RELOCATION
2010
DATA RELOCATING OPERATION COMPLETION

FIG.14

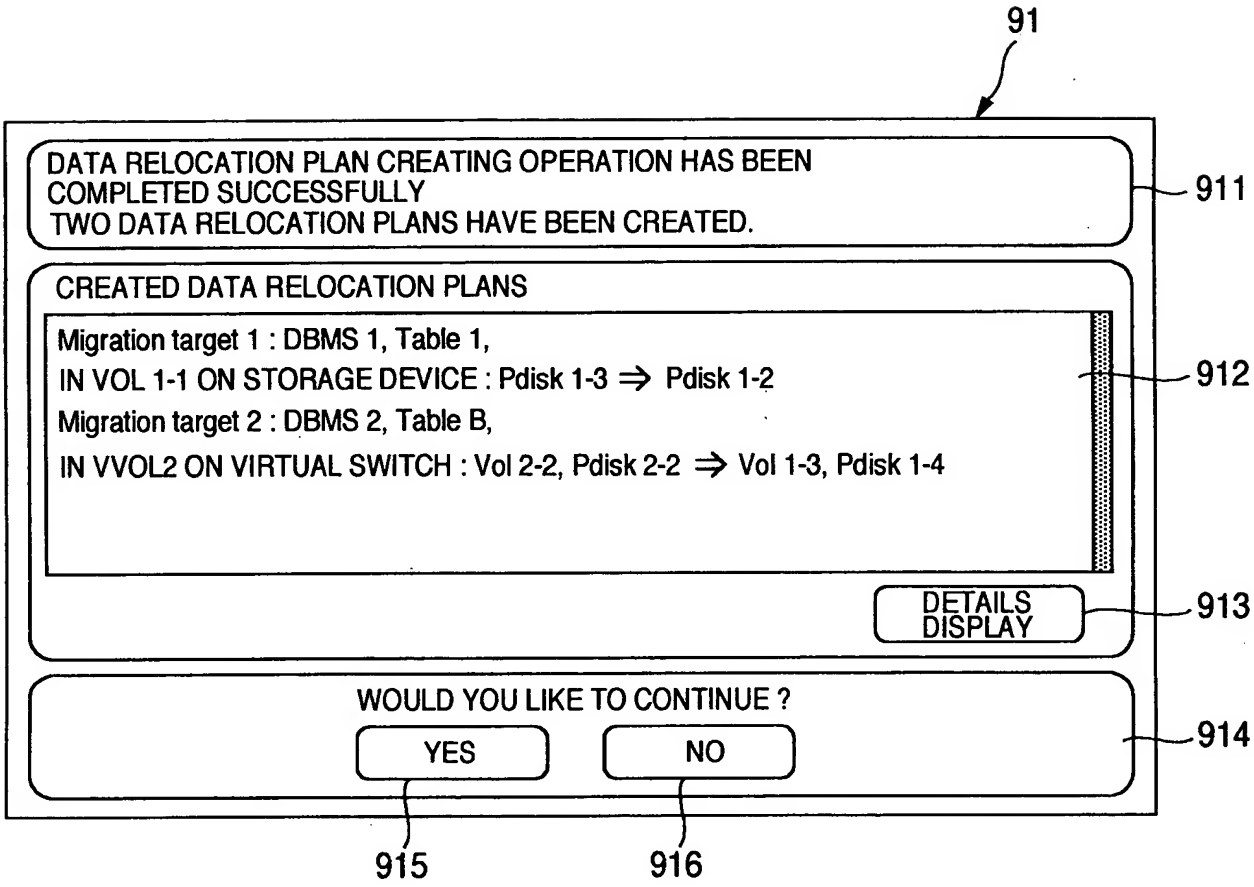

91
DATA RELOCATION PLAN CREATING OPERATION HAS BEEN COMPLETED SUCCESSFULLY
TWO DATA RELOCATION PLANS HAVE BEEN CREATED.
911
CREATED DATA RELOCATION PLANS
Migration target 1 : DBMS 1, Table 1,
IN VOL 1-1 ON STORAGE DEVICE : Pdisk 1-3 ⇒ Pdisk 1-2
Migration target 2 : DBMS 2, Table B,
IN VVOL2 ON VIRTUAL SWITCH : Vol 2-2, Pdisk 2-2 ⇒ Vol 1-3, Pdisk 1-4
912
DETAILS DISPLAY
913
WOULD YOU LIKE TO CONTINUE ?
YES
NO
914
915
916

FIG.15

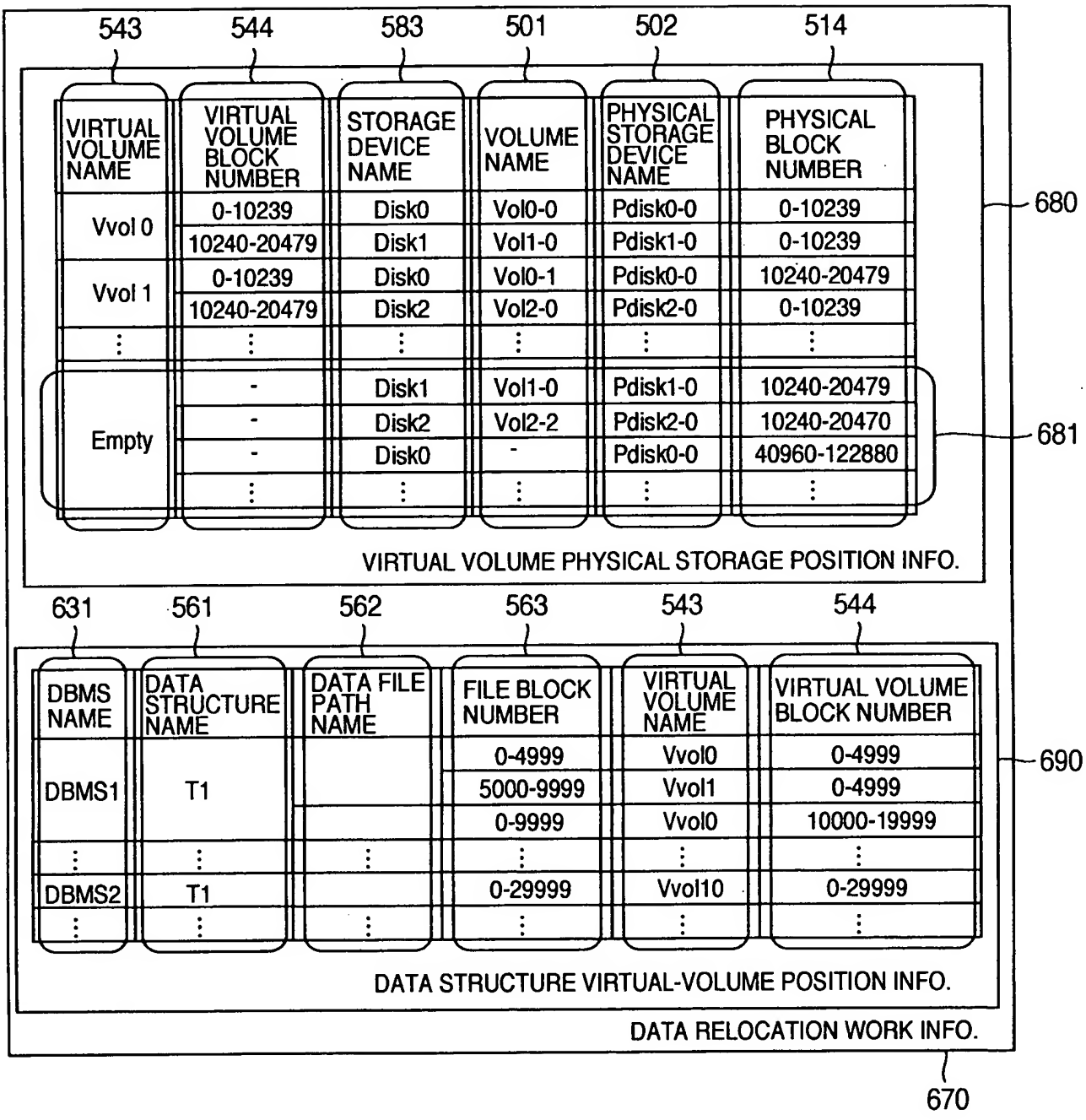

543
544
583
501
502
514
VIRTUAL VOLUME NAME
VIRTUAL VOLUME BLOCK NUMBER
STORAGE DEVICE NAME
VOLUME NAME
PHYSICAL STORAGE DEVICE NAME
PHYSICAL BLOCK NUMBER
Vvol 0
0-10239
Disk0
Vol0-0
Pdisk0-0
0-10239
10240-20479
Disk1
Vol1-0
Pdisk1-0
0-10239
Vvol 1
0-10239
Disk0
Vol0-1
Pdisk0-0
10240-20479
10240-20479
Disk2
Vol2-0
Pdisk2-0
0-10239
Empty
-
Disk1
Vol1-0
Pdisk1-0
10240-20479
-
Disk2
Vol2-2
Pdisk2-0
10240-20470
-
Disk0
-
Pdisk0-0
40960-122880
680
681
VIRTUAL VOLUME PHYSICAL STORAGE POSITION INFO.
631
561
562
563
543
544
DBMS NAME
DATA STRUCTURE NAME
DATA FILE PATH NAME
FILE BLOCK NUMBER
VIRTUAL VOLUME NAME
VIRTUAL VOLUME BLOCK NUMBER
DBMS1
T1
0-4999
Vvol0
0-4999
5000-9999
Vvol1
0-4999
0-9999
Vvol0
10000-19999
DBMS2
T1
0-29999
Vvol10
0-29999
690
DATA STRUCTURE VIRTUAL-VOLUME POSITION INFO.
DATA RELOCATION WORK INFO.
670

FIG.16

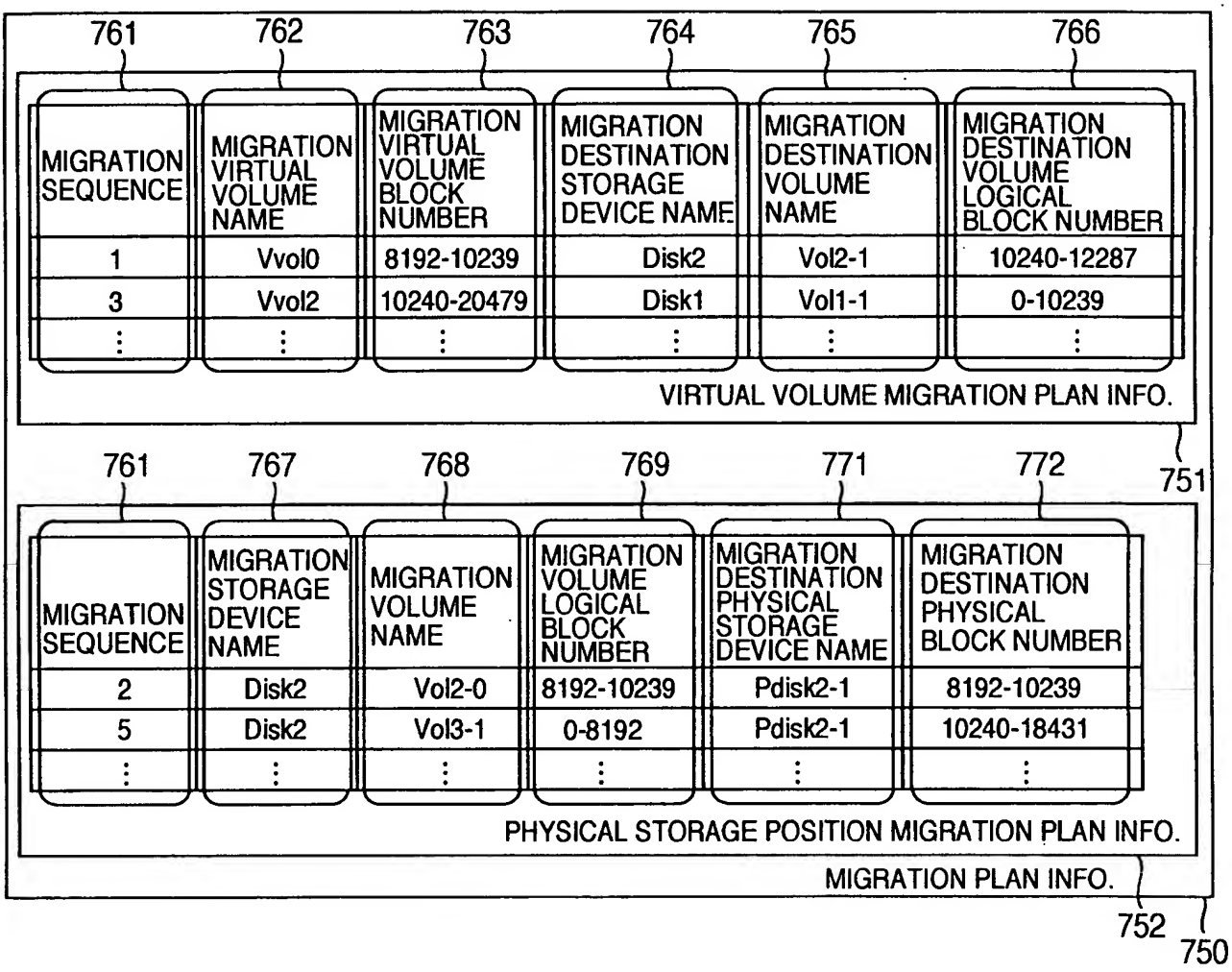

761
762
763
764
765
766
MIGRATION SEQUENCE
MIGRATION VIRTUAL VOLUME NAME
MIGRATION VIRTUAL VOLUME BLOCK NUMBER
MIGRATION DESTINATION STORAGE DEVICE NAME
MIGRATION DESTINATION VOLUME NAME
MIGRATION DESTINATION VOLUME LOGICAL BLOCK NUMBER
1
Vvol0
8192-10239
Disk2
Vol2-1
10240-12287
3
Vvol2
10240-20479
Disk1
Vol1-1
0-10239
VIRTUAL VOLUME MIGRATION PLAN INFO.
751
761
767
768
769
771
772
MIGRATION SEQUENCE
MIGRATION STORAGE DEVICE NAME
MIGRATION VOLUME NAME
MIGRATION VOLUME LOGICAL BLOCK NUMBER
MIGRATION DESTINATION PHYSICAL STORAGE DEVICE NAME
MIGRATION DESTINATION PHYSICAL BLOCK NUMBER
2
Disk2
Vol2-0
8192-10239
Pdisk2-1
8192-10239
5
Disk2
Vol3-1
0-8192
Pdisk2-1
10240-18431
PHYSICAL STORAGE POSITION MIGRATION PLAN INFO.
MIGRATION PLAN INFO.
752
750

FIG.17

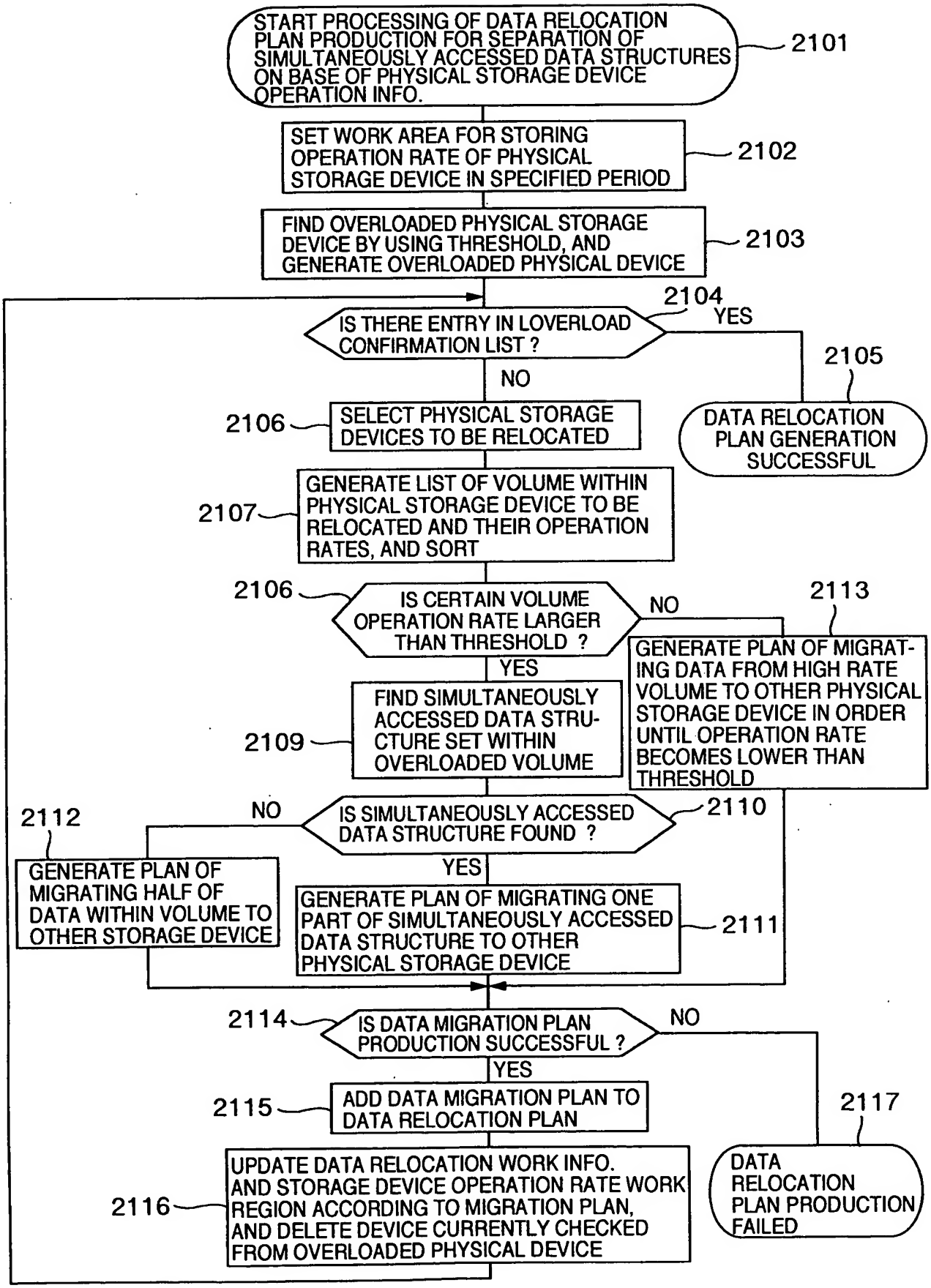

START PROCESSING OF DATA RELOCATION PLAN PRODUCTION FOR SEPARATION OF SIMULTANEOUSLY ACCESSED DATA STRUCTURES ON BASE OF PHYSICAL STORAGE DEVICE OPERATION INFO.
2101
SET WORK AREA FOR STORING OPERATION RATE OF PHYSICAL STORAGE DEVICE IN SPECIFIED PERIOD
2102
FIND OVERLOADED PHYSICAL STORAGE DEVICE BY USING THRESHOLD, AND GENERATE OVERLOADED PHYSICAL DEVICE
2103
2104
IS THERE ENTRY IN LOVERLOAD CONFIRMATION LIST ?
YES
NO
2105
DATA RELOCATION PLAN GENERATION SUCCESSFUL
2106
SELECT PHYSICAL STORAGE DEVICES TO BE RELOCATED
2107
GENERATE LIST OF VOLUME WITHIN PHYSICAL STORAGE DEVICE TO BE RELOCATED AND THEIR OPERATION RATES, AND SORT
2106
IS CERTAIN VOLUME OPERATION RATE LARGER THAN THRESHOLD ?
NO
2113
GENERATE PLAN OF MIGRATING DATA FROM HIGH RATE VOLUME TO OTHER PHYSICAL STORAGE DEVICE IN ORDER UNTIL OPERATION RATE BECOMES LOWER THAN THRESHOLD
YES
2109
FIND SIMULTANEOUSLY ACCESSED DATA STRUCTURE SET WITHIN OVERLOADED VOLUME
2112
NO
IS SIMULTANEOUSLY ACCESSED DATA STRUCTURE FOUND ?
2110
GENERATE PLAN OF MIGRATING HALF OF DATA WITHIN VOLUME TO OTHER STORAGE DEVICE
YES
GENERATE PLAN OF MIGRATING ONE PART OF SIMULTANEOUSLY ACCESSED DATA STRUCTURE TO OTHER PHYSICAL STORAGE DEVICE
2111
2114
IS DATA MIGRATION PLAN PRODUCTION SUCCESSFUL ?
NO
YES
2115
ADD DATA MIGRATION PLAN TO DATA RELOCATION PLAN
2117
DATA RELOCATION PLAN PRODUCTION FAILED
2116
UPDATE DATA RELOCATION WORK INFO. AND STORAGE DEVICE OPERATION RATE WORK REGION ACCORDING TO MIGRATION PLAN, AND DELETE DEVICE CURRENTLY CHECKED FROM OVERLOADED PHYSICAL DEVICE

FIG.18

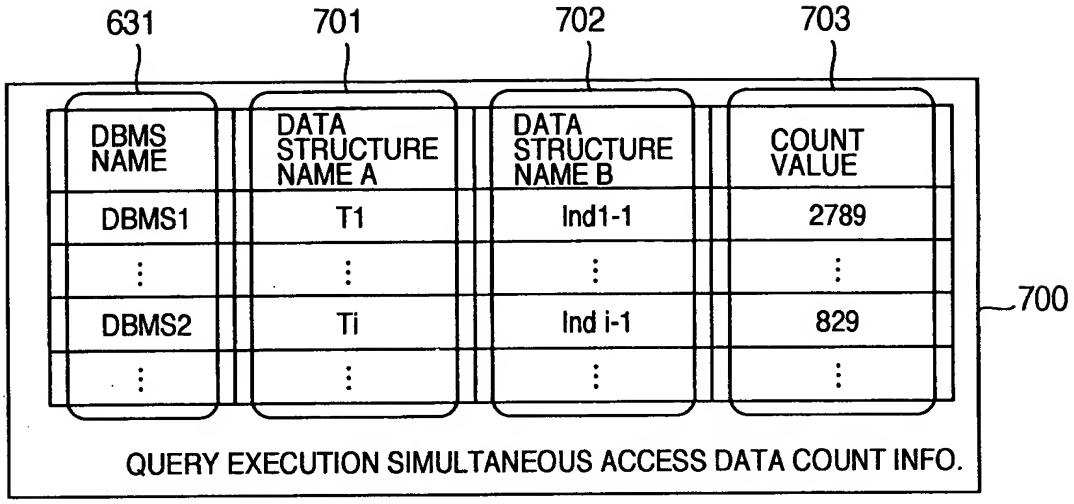

631
701
702
703
DBMS NAME
DATA STRUCTURE NAME A
DATA STRUCTURE NAME B
COUNT VALUE
DBMS1
T1
Ind1-1
2789
DBMS2
Ti
Ind i-1
829
700
QUERY EXECUTION SIMULTANEOUS ACCESS DATA COUNT INFO.

FIG.19

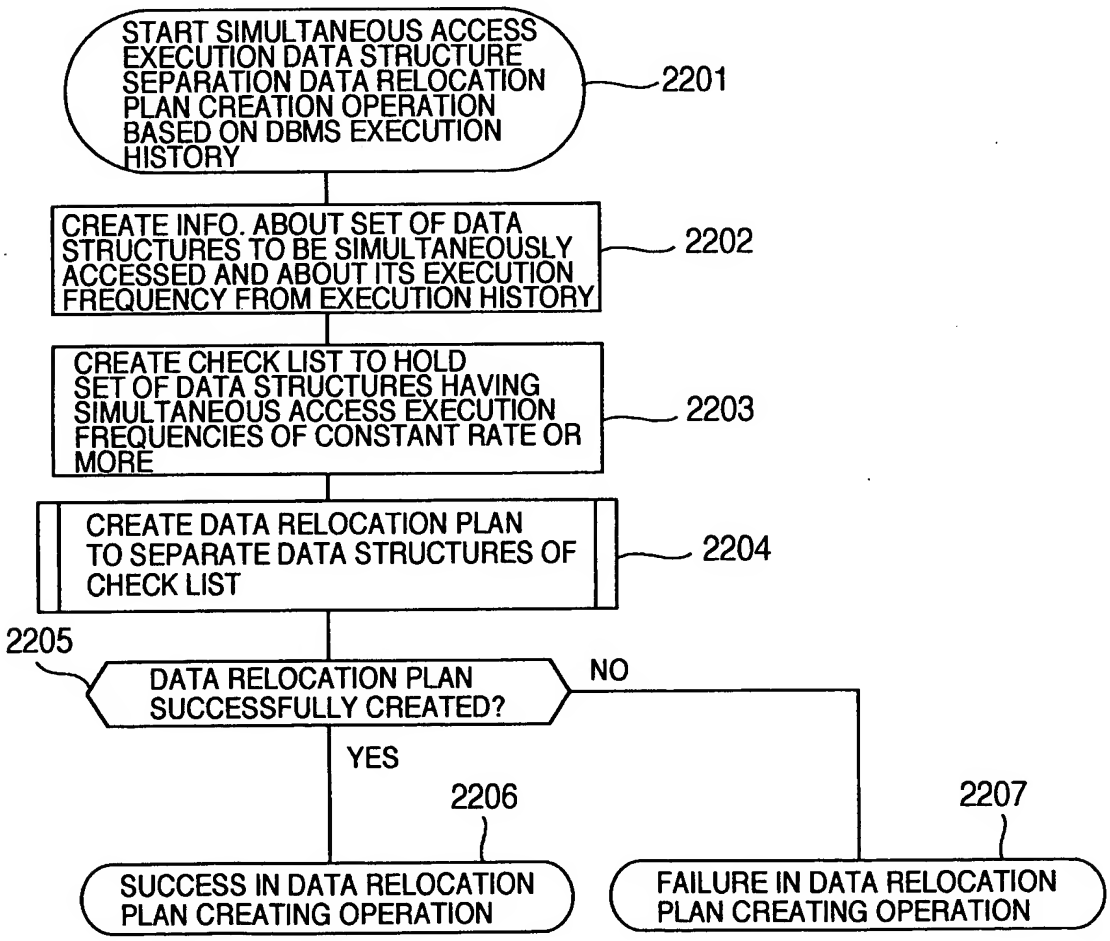

START SIMULTANEOUS ACCESS EXECUTION DATA STRUCTURE SEPARATION DATA RELOCATION PLAN CREATION OPERATION BASED ON DBMS EXECUTION HISTORY
2201
CREATE INFO. ABOUT SET OF DATA STRUCTURES TO BE SIMULTANEOUSLY ACCESSED AND ABOUT ITS EXECUTION FREQUENCY FROM EXECUTION HISTORY
2202
CREATE CHECK LIST TO HOLD SET OF DATA STRUCTURES HAVING SIMULTANEOUS ACCESS EXECUTION FREQUENCIES OF CONSTANT RATE OR MORE
2203
CREATE DATA RELOCATION PLAN TO SEPARATE DATA STRUCTURES OF CHECK LIST
2204
2205
DATA RELOCATION PLAN SUCCESSFULLY CREATED?
NO
YES
2206
2207
SUCCESS IN DATA RELOCATION PLAN CREATING OPERATION
FAILURE IN DATA RELOCATION PLAN CREATING OPERATION

FIG.20

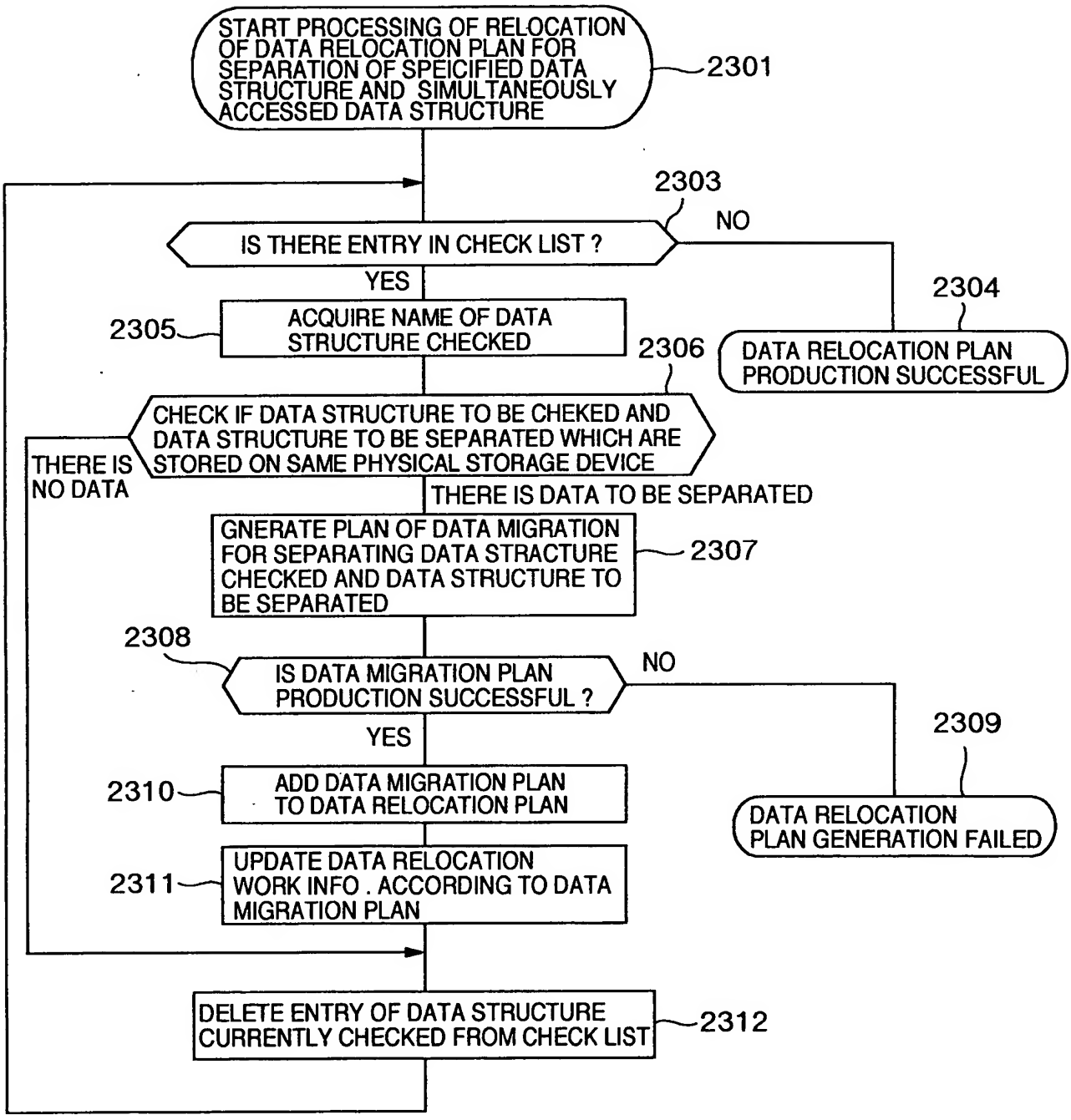

START PROCESSING OF RELOCATION OF DATA RELOCATION PLAN FOR SEPARATION OF SPEICIFIED DATA STRUCTURE AND SIMULTANEOUSLY ACCESSED DATA STRUCTURE
2301
2303
IS THERE ENTRY IN CHECK LIST ?
NO
YES
2304
DATA RELOCATION PLAN PRODUCTION SUCCESSFUL
2305
ACQUIRE NAME OF DATA STRUCTURE CHECKED
2306
CHECK IF DATA STRUCTURE TO BE CHEKED AND DATA STRUCTURE TO BE SEPARATED WHICH ARE STORED ON SAME PHYSICAL STORAGE DEVICE
THERE IS NO DATA
THERE IS DATA TO BE SEPARATED
GNERATE PLAN OF DATA MIGRATION FOR SEPARATING DATA STRACTURE CHECKED AND DATA STRUCTURE TO BE SEPARATED
2307
2308
IS DATA MIGRATION PLAN PRODUCTION SUCCESSFUL ?
NO
YES
2309
DATA RELOCATION PLAN GENERATION FAILED
2310
ADD DATA MIGRATION PLAN TO DATA RELOCATION PLAN
2311
UPDATE DATA RELOCATION WORK INFO . ACCORDING TO DATA MIGRATION PLAN
DELETE ENTRY OF DATA STRUCTURE CURRENTLY CHECKED FROM CHECK LIST
2312

FIG.21

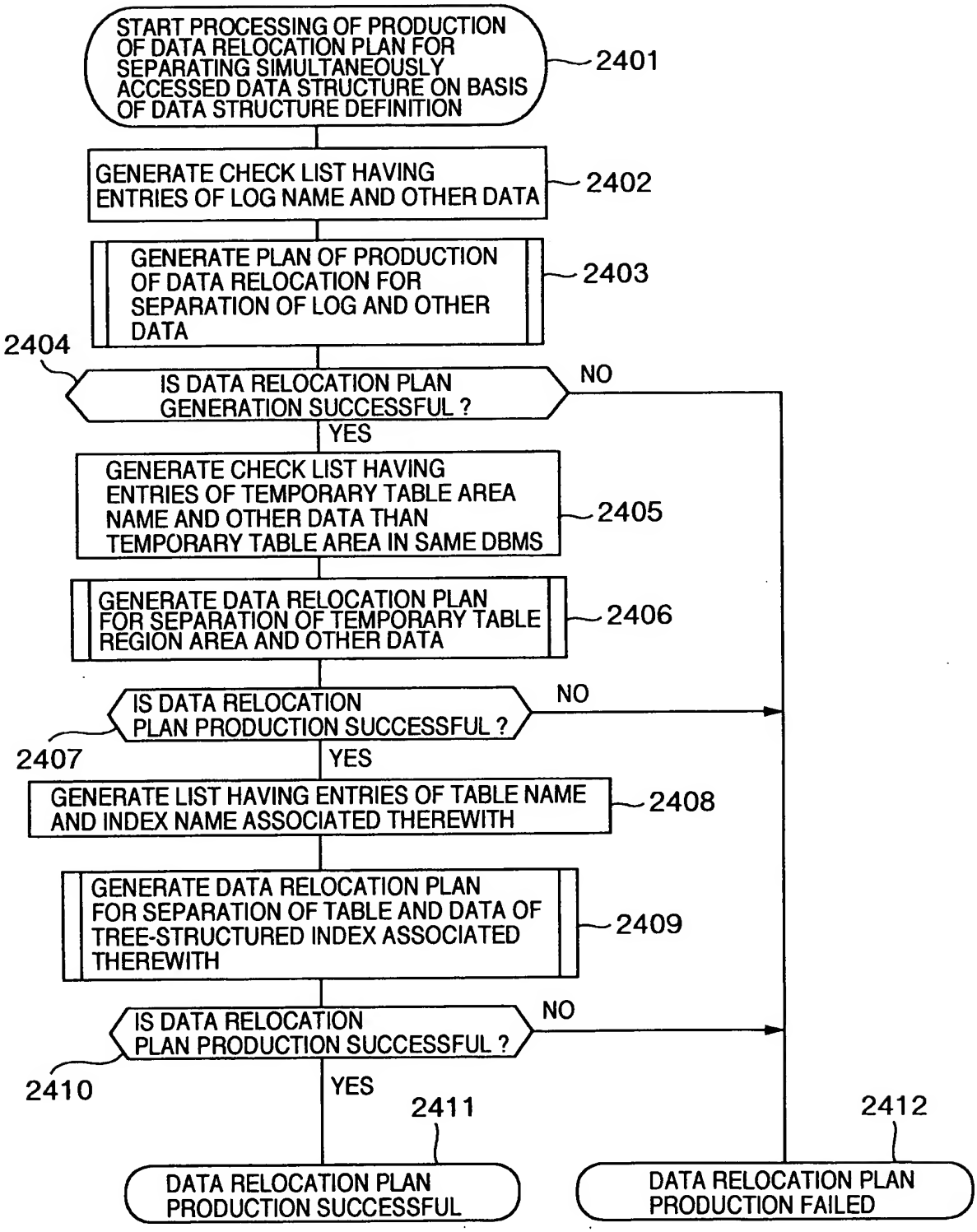

START PROCESSING OF PRODUCTION OF DATA RELOCATION PLAN FOR SEPARATING SIMULTANEOUSLY ACCESSED DATA STRUCTURE ON BASIS OF DATA STRUCTURE DEFINITION
2401
GENERATE CHECK LIST HAVING ENTRIES OF LOG NAME AND OTHER DATA
2402
GENERATE PLAN OF PRODUCTION OF DATA RELOCATION FOR SEPARATION OF LOG AND OTHER DATA
2403
2404
IS DATA RELOCATION PLAN GENERATION SUCCESSFUL ?
NO
YES
GENERATE CHECK LIST HAVING ENTRIES OF TEMPORARY TABLE AREA NAME AND OTHER DATA THAN TEMPORARY TABLE AREA IN SAME DBMS
2405
GENERATE DATA RELOCATION PLAN FOR SEPARATION OF TEMPORARY TABLE REGION AREA AND OTHER DATA
2406
IS DATA RELOCATION PLAN PRODUCTION SUCCESSFUL ?
NO
2407
YES
GENERATE LIST HAVING ENTRIES OF TABLE NAME AND INDEX NAME ASSOCIATED THEREWITH
2408
GENERATE DATA RELOCATION PLAN FOR SEPARATION OF TABLE AND DATA OF TREE-STRUCTURED INDEX ASSOCIATED THEREWITH
2409
IS DATA RELOCATION PLAN PRODUCTION SUCCESSFUL ?
NO
2410
YES
2411
2412
DATA RELOCATION PLAN PRODUCTION SUCCESSFUL
DATA RELOCATION PLAN PRODUCTION FAILED

FIG.22

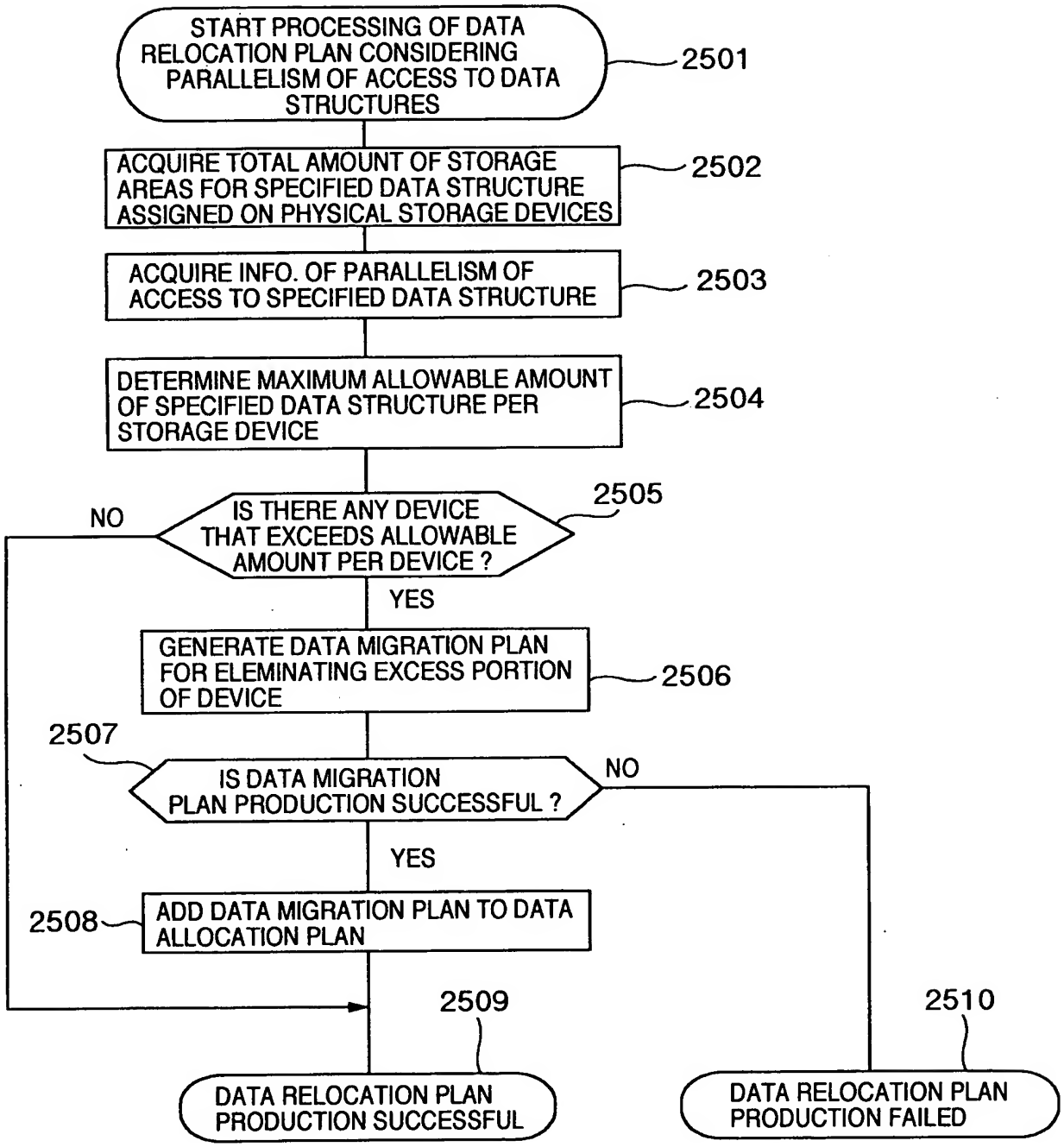

START PROCESSING OF DATA RELOCATION PLAN CONSIDERING PARALLELISM OF ACCESS TO DATA STRUCTURES
2501
ACQUIRE TOTAL AMOUNT OF STORAGE AREAS FOR SPECIFIED DATA STRUCTURE ASSIGNED ON PHYSICAL STORAGE DEVICES
2502
ACQUIRE INFO. OF PARALLELISM OF ACCESS TO SPECIFIED DATA STRUCTURE
2503
DETERMINE MAXIMUM ALLOWABLE AMOUNT OF SPECIFIED DATA STRUCTURE PER STORAGE DEVICE
2504
IS THERE ANY DEVICE THAT EXCEEDS ALLOWABLE AMOUNT PER DEVICE ?
2505
NO
YES
GENERATE DATA MIGRATION PLAN FOR ELEMINATING EXCESS PORTION OF DEVICE
2506
2507
IS DATA MIGRATION PLAN PRODUCTION SUCCESSFUL ?
NO
YES
2508
ADD DATA MIGRATION PLAN TO DATA ALLOCATION PLAN
2509
2510
DATA RELOCATION PLAN PRODUCTION SUCCESSFUL
DATA RELOCATION PLAN PRODUCTION FAILED

FIG.23

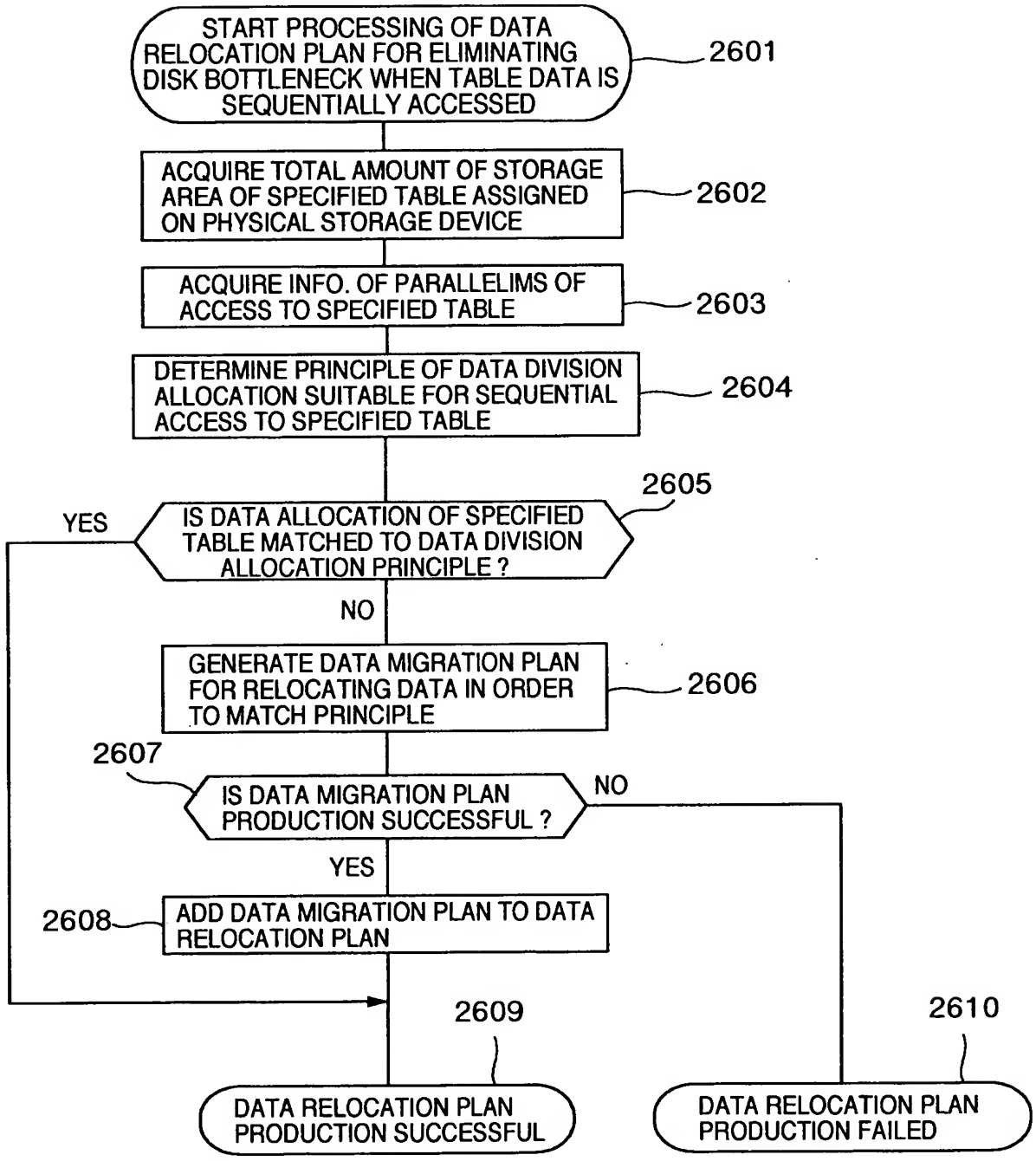

START PROCESSING OF DATA RELOCATION PLAN FOR ELIMINATING DISK BOTTLENECK WHEN TABLE DATA IS SEQUENTIALLY ACCESSED
2601
ACQUIRE TOTAL AMOUNT OF STORAGE AREA OF SPECIFIED TABLE ASSIGNED ON PHYSICAL STORAGE DEVICE
2602
ACQUIRE INFO. OF PARALLELIMS OF ACCESS TO SPECIFIED TABLE
2603
DETERMINE PRINCIPLE OF DATA DIVISION ALLOCATION SUITABLE FOR SEQUENTIAL ACCESS TO SPECIFIED TABLE
2604
2605
YES
IS DATA ALLOCATION OF SPECIFIED TABLE MATCHED TO DATA DIVISION ALLOCATION PRINCIPLE ?
NO
GENERATE DATA MIGRATION PLAN FOR RELOCATING DATA IN ORDER TO MATCH PRINCIPLE
2606
2607
IS DATA MIGRATION PLAN PRODUCTION SUCCESSFUL ?
NO
YES
2608
ADD DATA MIGRATION PLAN TO DATA RELOCATION PLAN
2609
2610
DATA RELOCATION PLAN PRODUCTION SUCCESSFUL
DATA RELOCATION PLAN PRODUCTION FAILED

FIG.24

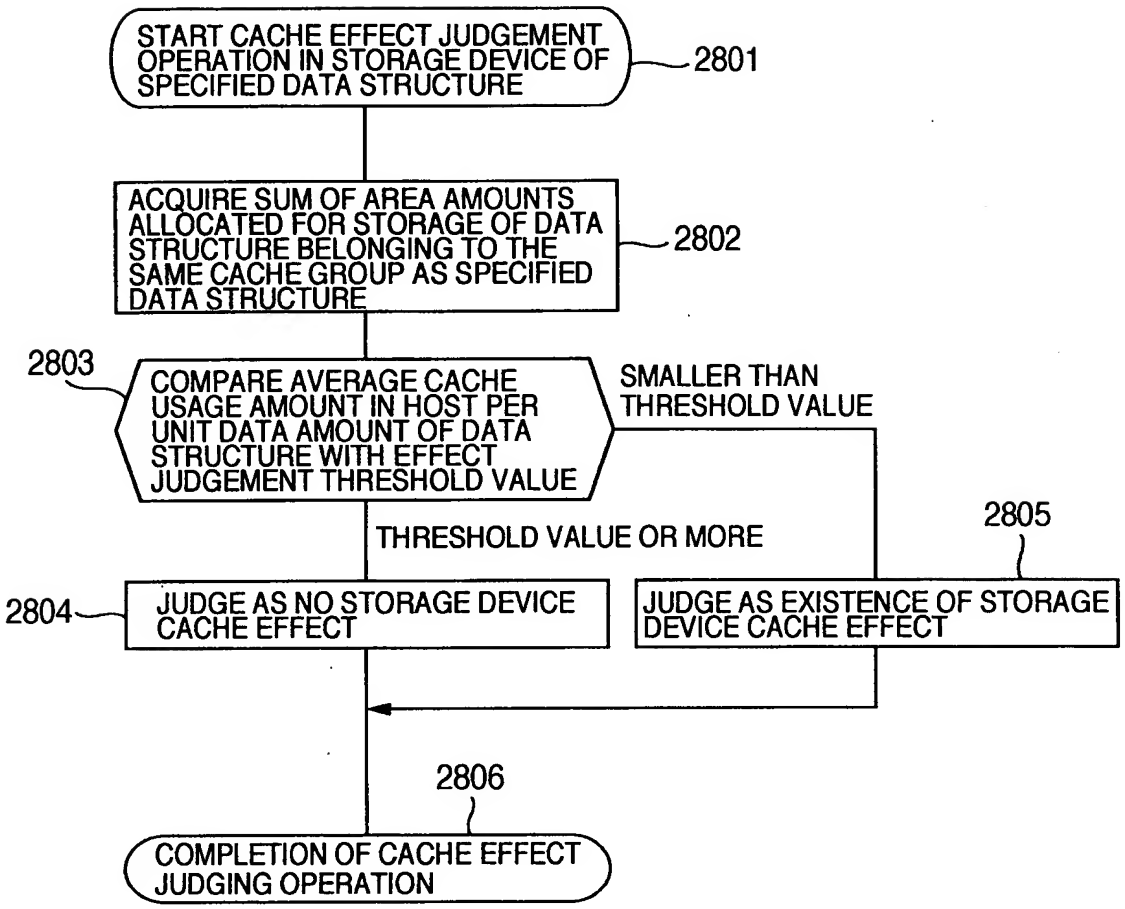

START CACHE EFFECT JUDGEMENT OPERATION IN STORAGE DEVICE OF SPECIFIED DATA STRUCTURE
2801
ACQUIRE SUM OF AREA AMOUNTS ALLOCATED FOR STORAGE OF DATA STRUCTURE BELONGING TO THE SAME CACHE GROUP AS SPECIFIED DATA STRUCTURE
2802
2803
COMPARE AVERAGE CACHE USAGE AMOUNT IN HOST PER UNIT DATA AMOUNT OF DATA STRUCTURE WITH EFFECT JUDGEMENT THRESHOLD VALUE
SMALLER THAN THRESHOLD VALUE
THRESHOLD VALUE OR MORE
2805
2804
JUDGE AS NO STORAGE DEVICE CACHE EFFECT
JUDGE AS EXISTENCE OF STORAGE DEVICE CACHE EFFECT
2806
COMPLETION OF CACHE EFFECT JUDGING OPERATION

FIG.25

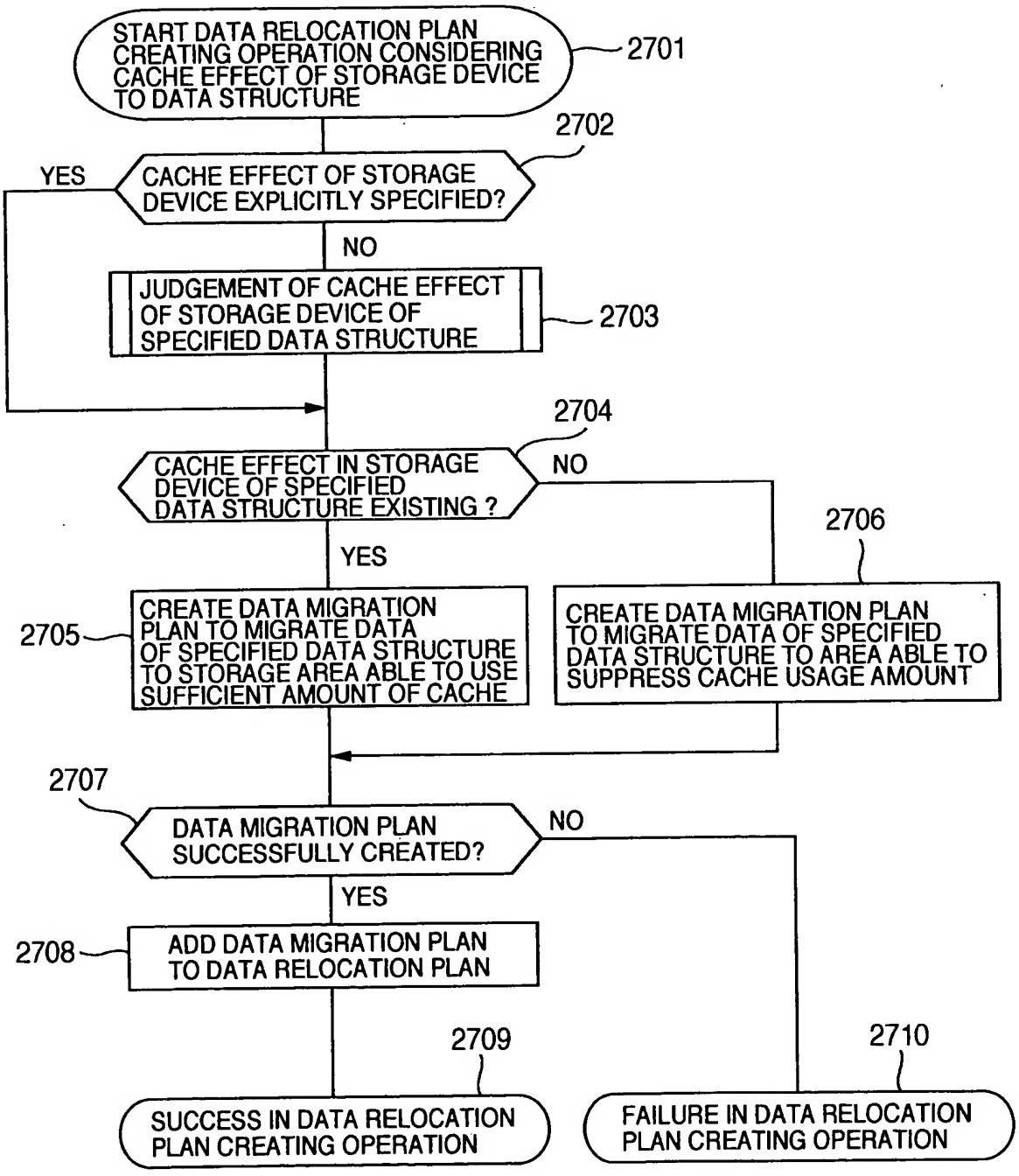

START DATA RELOCATION PLAN CREATING OPERATION CONSIDERING CACHE EFFECT OF STORAGE DEVICE TO DATA STRUCTURE
2701
2702
YES
CACHE EFFECT OF STORAGE DEVICE EXPLICITLY SPECIFIED?
NO
JUDGEMENT OF CACHE EFFECT OF STORAGE DEVICE OF SPECIFIED DATA STRUCTURE
2703
2704
CACHE EFFECT IN STORAGE DEVICE OF SPECIFIED DATA STRUCTURE EXISTING ?
NO
2706
YES
2705
CREATE DATA MIGRATION PLAN TO MIGRATE DATA OF SPECIFIED DATA STRUCTURE TO STORAGE AREA ABLE TO USE SUFFICIENT AMOUNT OF CACHE
CREATE DATA MIGRATION PLAN TO MIGRATE DATA OF SPECIFIED DATA STRUCTURE TO AREA ABLE TO SUPPRESS CACHE USAGE AMOUNT
2707
DATA MIGRATION PLAN SUCCESSFULLY CREATED?
NO
YES
2708
ADD DATA MIGRATION PLAN TO DATA RELOCATION PLAN
2709
2710
SUCCESS IN DATA RELOCATION PLAN CREATING OPERATION
FAILURE IN DATA RELOCATION PLAN CREATING OPERATION

FIG.26

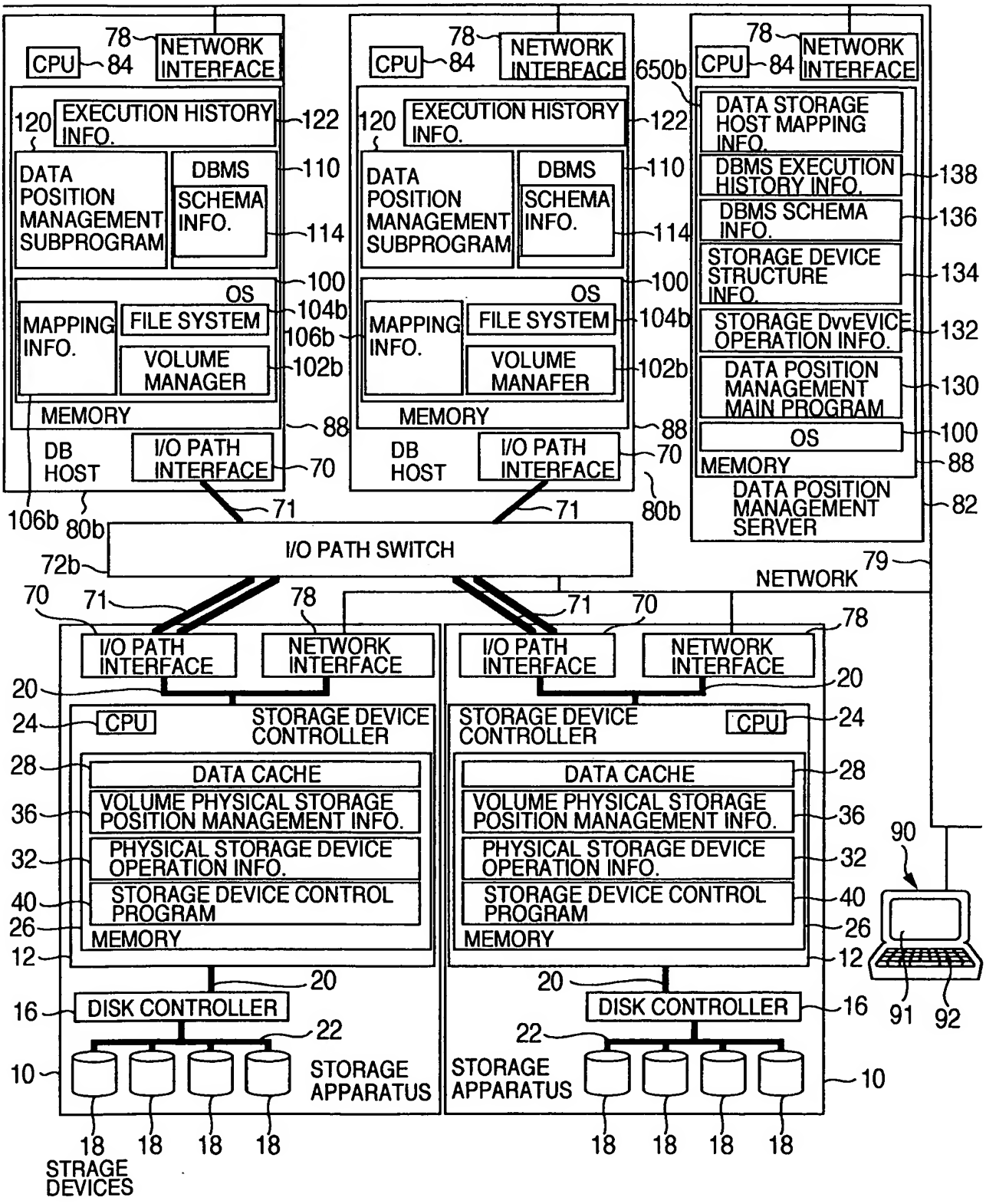

CPU
84
78
NETWORK INTERFACE
120
EXECUTION HISTORY INFO.
122
DATA POSITION MANAGEMENT SUBPROGRAM
DBMS
110
SCHEMA INFO.
114
100
OS
MAPPING INFO.
FILE SYSTEM
104b
106b
VOLUME MANAGER
102b
MEMORY
88
DB HOST
I/O PATH INTERFACE
70
71
106b
80b
650b
DATA STORAGE HOST MAPPING INFO.
DBMS EXECUTION HISTORY INFO.
138
DBMS SCHEMA INFO.
136
STORAGE DEVICE STRUCTURE INFO.
134
STORAGE DEVICE OPERATION INFO.
132
DATA POSITION MANAGEMENT MAIN PROGRAM
130
DATA POSITION MANAGEMENT SERVER
82
I/O PATH SWITCH
72b
NETWORK
79
90
91
92
STORAGE DEVICE CONTROLLER
24
DATA CACHE
28
VOLUME PHYSICAL STORAGE POSITION MANAGEMENT INFO.
36
PHYSICAL STORAGE DEVICE OPERATION INFO.
32
STORAGE DEVICE CONTROL PROGRAM
40
26
12
20
DISK CONTROLLER
16
22
10
STORAGE APPARATUS
18
STRAGE DEVICES

FIG.27

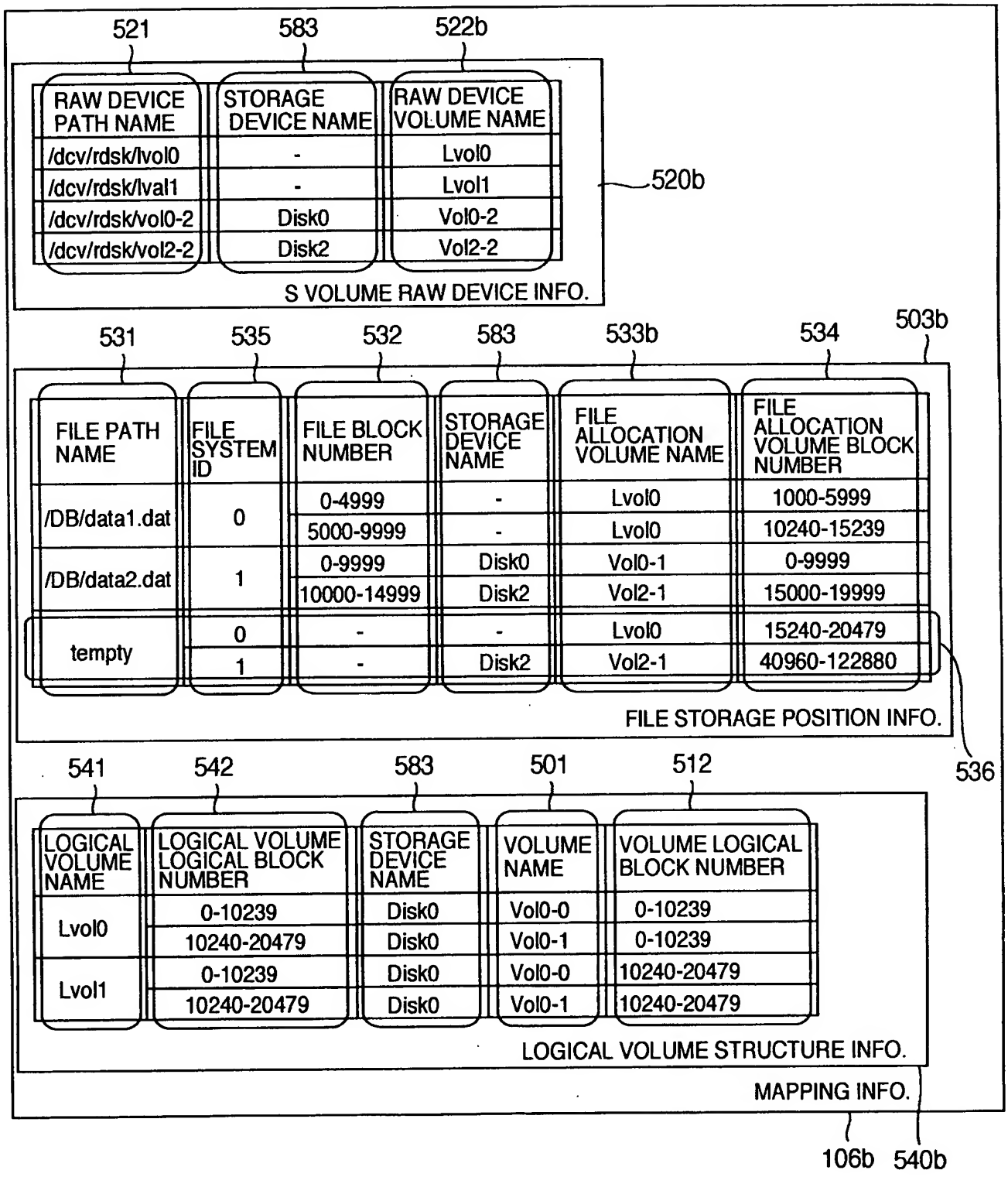

521
583
522b
RAW DEVICE PATH NAME
STORAGE DEVICE NAME
RAW DEVICE VOLUME NAME
/dcv/rdsk/lvol0 - Lvol0
/dcv/rdsk/lval1 - Lvol1
/dcv/rdsk/vol0-2 Disk0 Vol0-2
/dcv/rdsk/vol2-2 Disk2 Vol2-2
S VOLUME RAW DEVICE INFO.
520b
503b
531
535
532
583
533b
534
FILE PATH NAME
FILE SYSTEM ID
FILE BLOCK NUMBER
STORAGE DEVICE NAME
FILE ALLOCATION VOLUME NAME
FILE ALLOCATION VOLUME BLOCK NUMBER
/DB/data1.dat 0 0-4999 - Lvol0 1000-5999
5000-9999 - Lvol0 10240-15239
/DB/data2.dat 1 0-9999 Disk0 Vol0-1 0-9999
10000-14999 Disk2 Vol2-1 15000-19999
tempty 0 - - Lvol0 15240-20479
1 - Disk2 Vol2-1 40960-122880
FILE STORAGE POSITION INFO.
536
541
542
583
501
512
LOGICAL VOLUME NAME
LOGICAL VOLUME LOGICAL BLOCK NUMBER
STORAGE DEVICE NAME
VOLUME NAME
VOLUME LOGICAL BLOCK NUMBER
Lvol0 0-10239 Disk0 Vol0-0 0-10239
10240-20479 Disk0 Vol0-1 0-10239
Lvol1 0-10239 Disk0 Vol0-0 10240-20479
10240-20479 Disk0 Vol0-1 10240-20479
LOGICAL VOLUME STRUCTURE INFO.
MAPPING INFO.
106b
540b

FIG.28

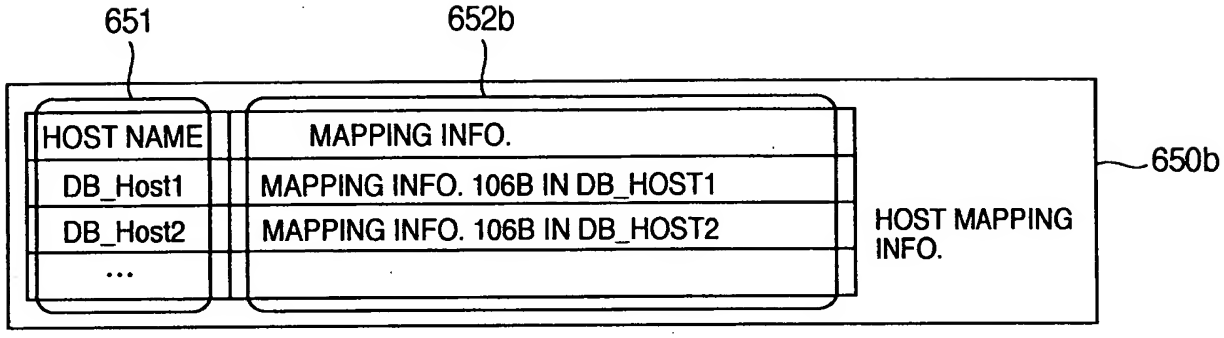

651
652b
HOST NAME
MAPPING INFO.
DB_Host1
MAPPING INFO. 106B IN DB_HOST1
DB_Host2
MAPPING INFO. 106B IN DB_HOST2
...
HOST MAPPING INFO.
650b

FIG.29

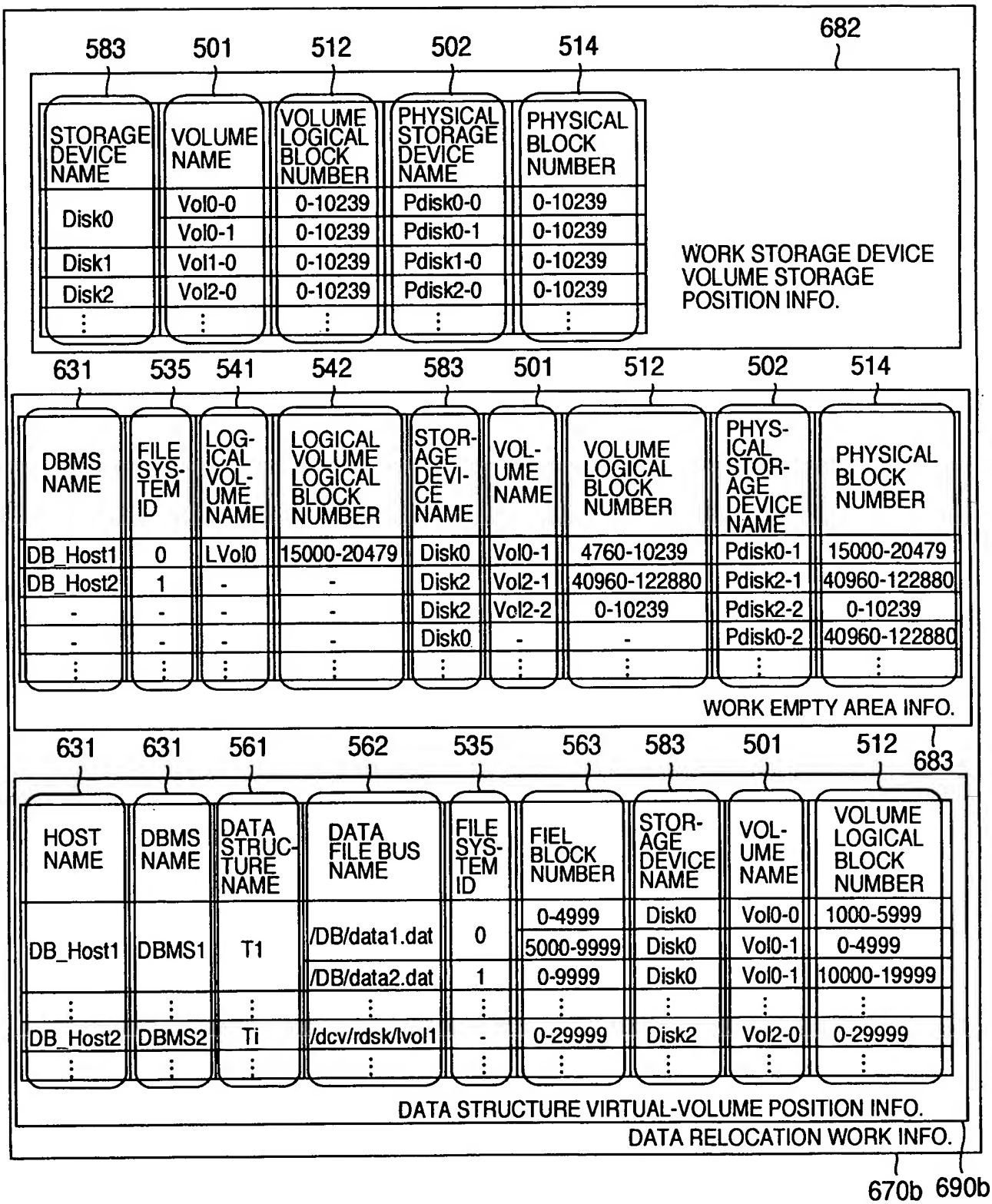

583
501
512
502
514
682
STORAGE DEVICE NAME
VOLUME NAME
VOLUME LOGICAL BLOCK NUMBER
PHYSICAL STORAGE DEVICE NAME
PHYSICAL BLOCK NUMBER
Disk0
Vol0-0
0-10239
Pdisk0-0
0-10239
Vol0-1
0-10239
Pdisk0-1
0-10239
Disk1
Vol1-0
0-10239
Pdisk1-0
0-10239
Disk2
Vol2-0
0-10239
Pdisk2-0
0-10239
WORK STORAGE DEVICE VOLUME STORAGE POSITION INFO.
631
535
541
542
583
501
512
502
514
DBMS NAME
FILE SYS-TEM ID
LOG-ICAL VOL-UME NAME
LOGICAL VOLUME LOGICAL BLOCK NUMBER
STOR-AGE DEVI-CE NAME
VOL-UME NAME
VOLUME LOGICAL BLOCK NUMBER
PHYS-ICAL STOR-AGE DEVICE NAME
PHYSICAL BLOCK NUMBER
DB_Host1
0
LVol0
15000-20479
Disk0
Vol0-1
4760-10239
Pdisk0-1
15000-20479
DB_Host2
1
-
-
Disk2
Vol2-1
40960-122880
Pdisk2-1
40960-122880
-
-
-
-
Disk2
Vol2-2
0-10239
Pdisk2-2
0-10239
-
-
-
-
Disk0
-
-
Pdisk0-2
40960-122880
WORK EMPTY AREA INFO.
631
631
561
562
535
563
583
501
512
683
HOST NAME
DBMS NAME
DATA STRUC-TURE NAME
DATA FILE BUS NAME
FILE SYS-TEM ID
FIEL BLOCK NUMBER
STOR-AGE DEVICE NAME
VOL-UME NAME
VOLUME LOGICAL BLOCK NUMBER
DB_Host1
DBMS1
T1
/DB/data1.dat
0
0-4999
Disk0
Vol0-0
1000-5999
5000-9999
Disk0
Vol0-1
0-4999
/DB/data2.dat
1
0-9999
Disk0
Vol0-1
10000-19999
DB_Host2
DBMS2
Ti
/dcv/rdsk/lvol1
-
0-29999
Disk2
Vol2-0
0-29999
DATA STRUCTURE VIRTUAL-VOLUME POSITION INFO.
DATA RELOCATION WORK INFO.
670b
690b

FIG.30

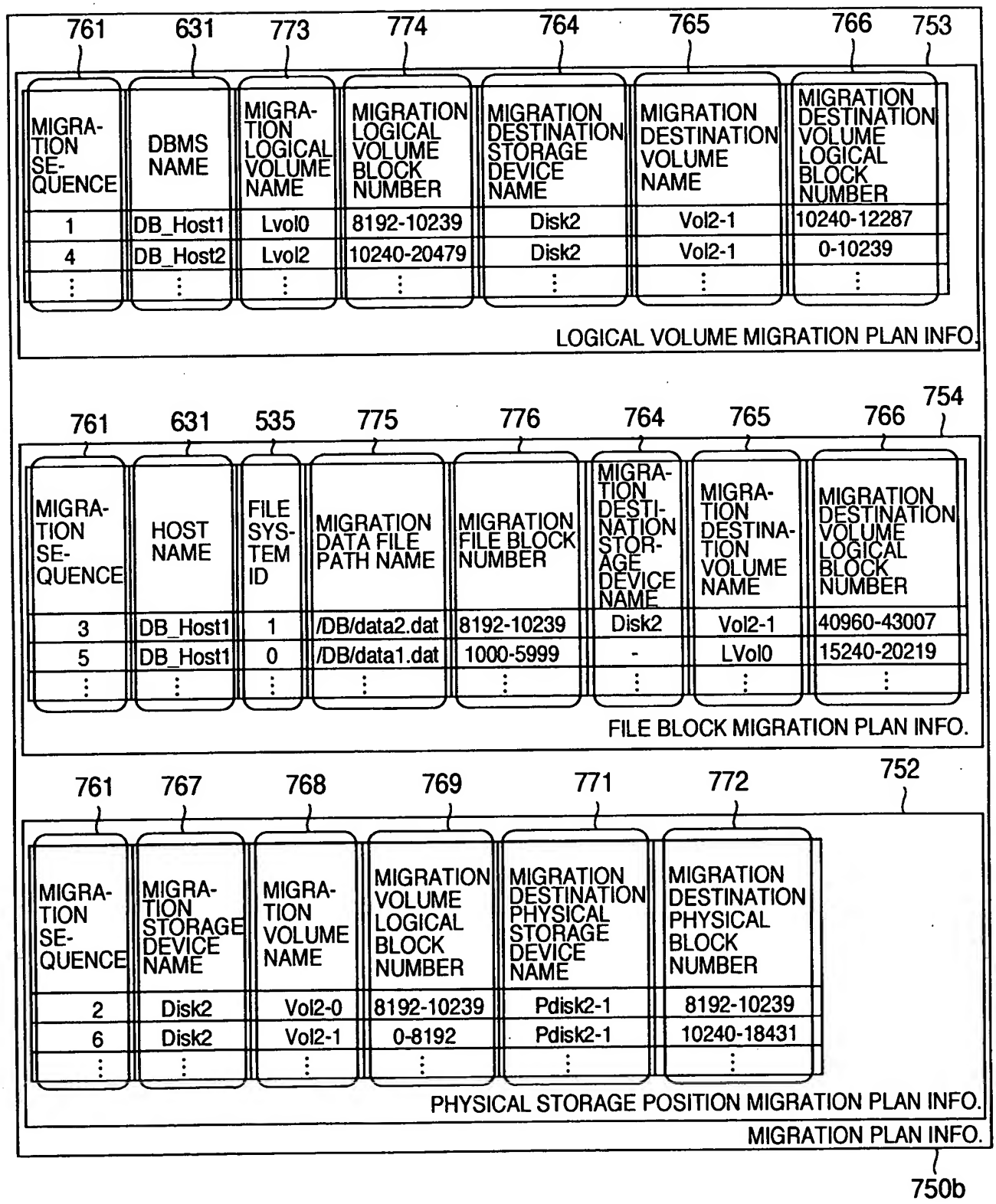

761
631
773
774
764
765
766
753
MIGRATION SEQUENCE
DBMS NAME
MIGRATION LOGICAL VOLUME NAME
MIGRATION LOGICAL VOLUME BLOCK NUMBER
MIGRATION DESTINATION STORAGE DEVICE NAME
MIGRATION DESTINATION VOLUME NAME
MIGRATION DESTINATION VOLUME LOGICAL BLOCK NUMBER
1 DB_Host1 Lvol0 8192-10239 Disk2 Vol2-1 10240-12287
4 DB_Host2 Lvol2 10240-20479 Disk2 Vol2-1 0-10239
LOGICAL VOLUME MIGRATION PLAN INFO.
754
761
631
535
775
776
764
765
766
MIGRATION SEQUENCE
HOST NAME
FILE SYSTEM ID
MIGRATION DATA FILE PATH NAME
MIGRATION FILE BLOCK NUMBER
MIGRATION DESTINATION STORAGE DEVICE NAME
MIGRATION DESTINATION VOLUME NAME
MIGRATION DESTINATION VOLUME LOGICAL BLOCK NUMBER
3 DB_Host1 1 /DB/data2.dat 8192-10239 Disk2 Vol2-1 40960-43007
5 DB_Host1 0 /DB/data1.dat 1000-5999 - LVol0 15240-20219
FILE BLOCK MIGRATION PLAN INFO.
752
761
767
768
769
771
772
MIGRATION SEQUENCE
MIGRATION STORAGE DEVICE NAME
MIGRATION VOLUME NAME
MIGRATION VOLUME LOGICAL BLOCK NUMBER
MIGRATION DESTINATION PHYSICAL STORAGE DEVICE NAME
MIGRATION DESTINATION PHYSICAL BLOCK NUMBER
2 Disk2 Vol2-0 8192-10239 Pdisk2-1 8192-10239
6 Disk2 Vol2-1 0-8192 Pdisk2-1 10240-18431
PHYSICAL STORAGE POSITION MIGRATION PLAN INFO.
MIGRATION PLAN INFO.
750b

FIG.31

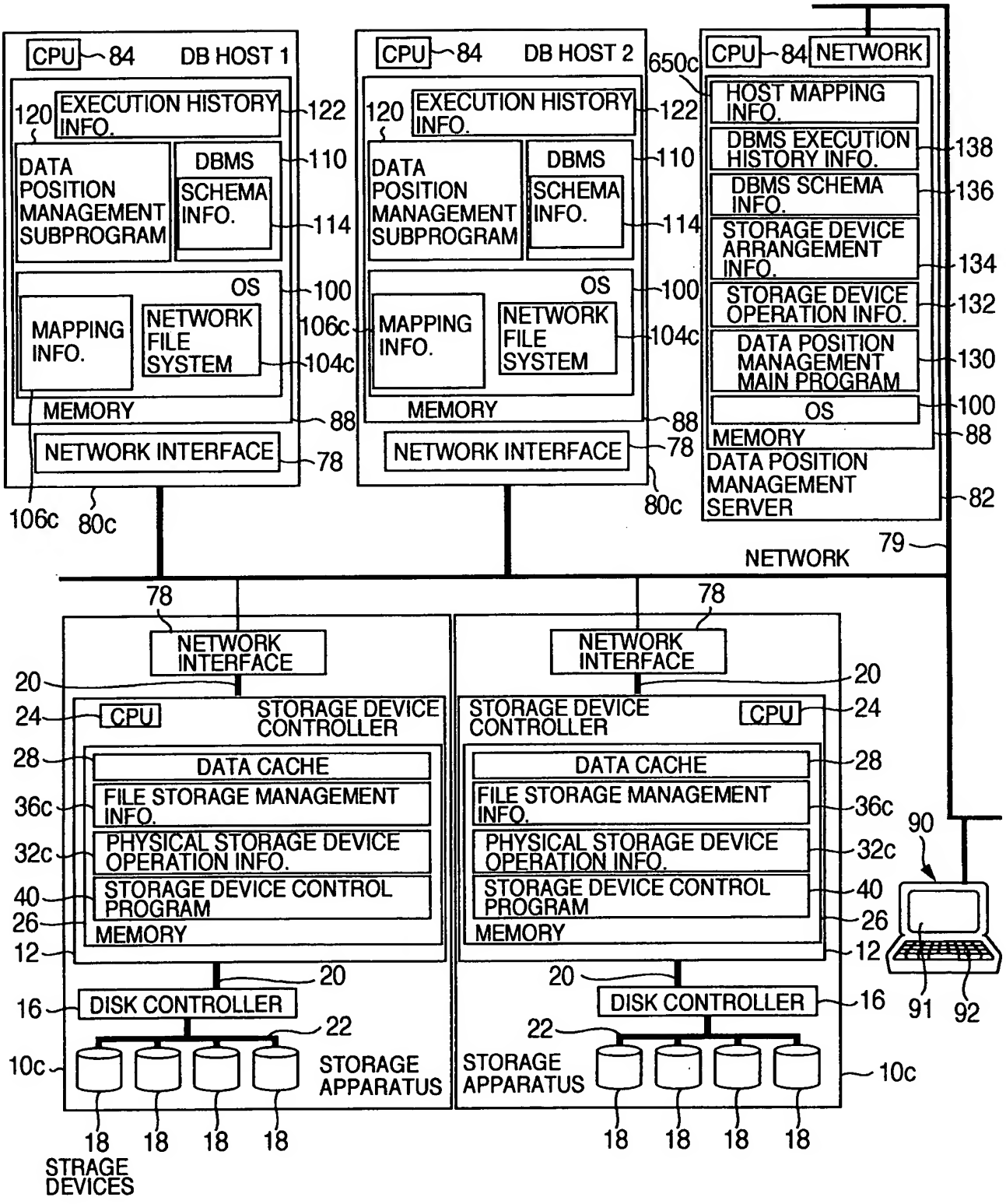

CPU
84
DB HOST 1
EXECUTION HISTORY INFO.
120
122
DATA POSITION MANAGEMENT SUBPROGRAM
DBMS
110
SCHEMA INFO.
114
OS
100
MAPPING INFO.
106c
NETWORK FILE SYSTEM
104c
MEMORY
88
NETWORK INTERFACE
78
80c
DB HOST 2
650c
NETWORK
HOST MAPPING INFO.
DBMS EXECUTION HISTORY INFO.
138
DBMS SCHEMA INFO.
136
STORAGE DEVICE ARRANGEMENT INFO.
134
STORAGE DEVICE OPERATION INFO.
132
DATA POSITION MANAGEMENT MAIN PROGRAM
130
DATA POSITION MANAGEMENT SERVER
82
79
NETWORK
STORAGE DEVICE CONTROLLER
20
24
28
DATA CACHE
36c
FILE STORAGE MANAGEMENT INFO.
32c
PHYSICAL STORAGE DEVICE OPERATION INFO.
40
STORAGE DEVICE CONTROL PROGRAM
26
12
DISK CONTROLLER
16
22
10c
STORAGE APPARATUS
18
STRAGE DEVICES
90
91
92

FIG.32

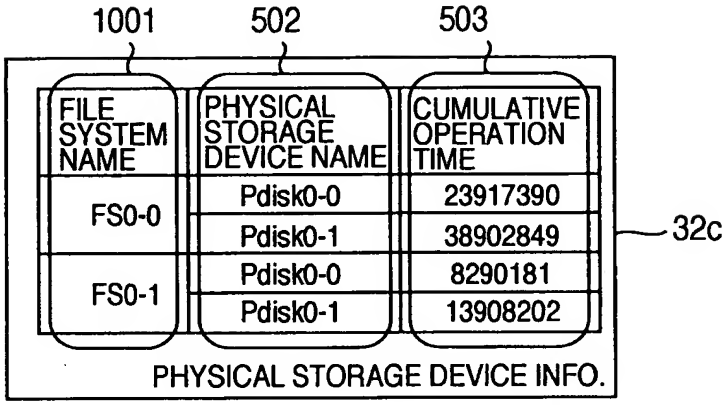

1001
502
503
FILE SYSTEM NAME
PHYSICAL STORAGE DEVICE NAME
CUMULATIVE OPERATION TIME
FS0-0
Pdisk0-0
23917390
Pdisk0-1
38902849
FS0-1
Pdisk0-0
8290181
Pdisk0-1
13908202
32c
PHYSICAL STORAGE DEVICE INFO.

FIG.33

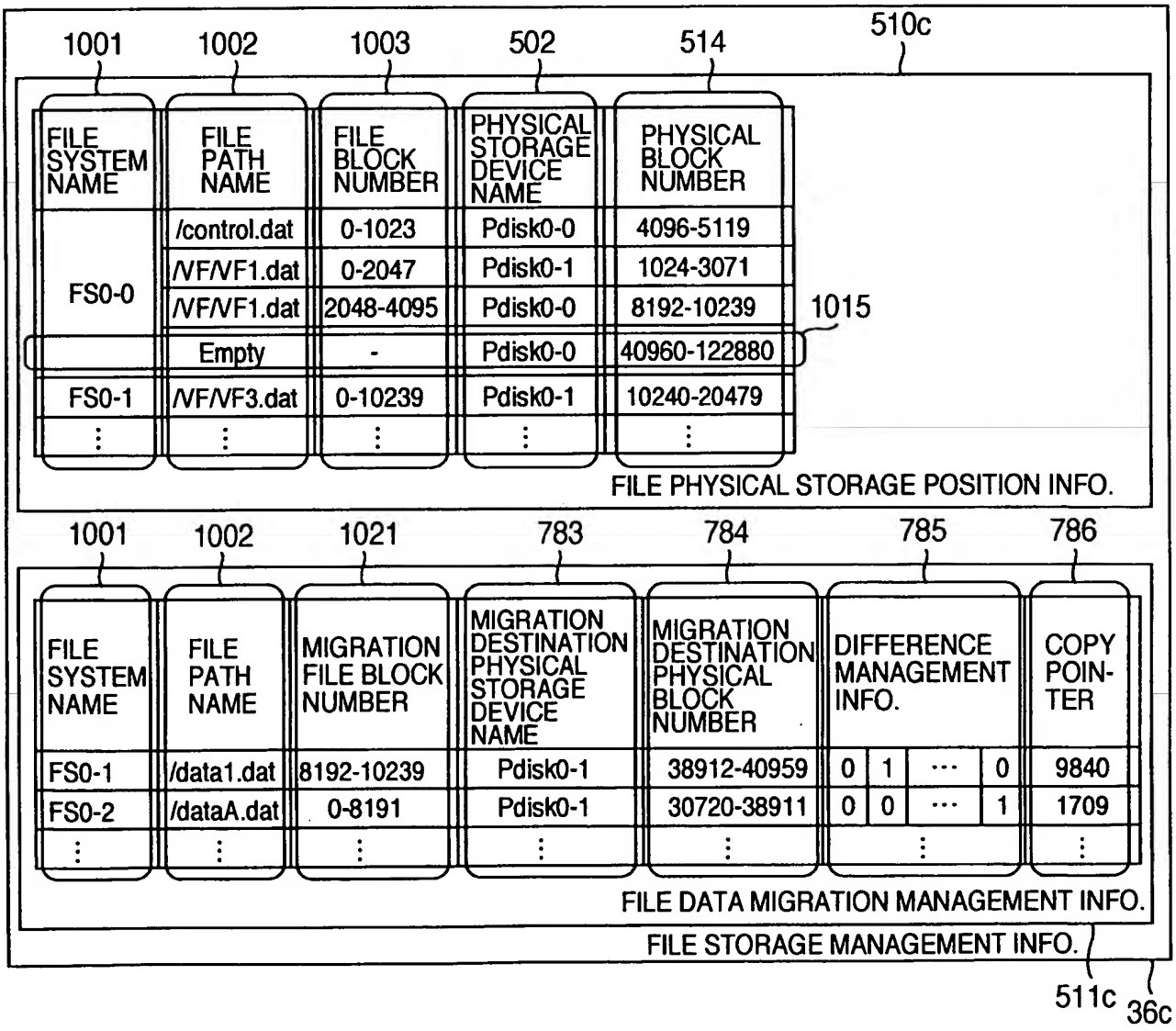

510c
1001
1002
1003
502
514
FILE SYSTEM NAME
FILE PATH NAME
FILE BLOCK NUMBER
PHYSICAL STORAGE DEVICE NAME
PHYSICAL BLOCK NUMBER
/control.dat
0-1023
Pdisk0-0
4096-5119
FS0-0
/VF/VF1.dat
0-2047
Pdisk0-1
1024-3071
/VF/VF1.dat
2048-4095
Pdisk0-0
8192-10239
1015
Empty
-
Pdisk0-0
40960-122880
FS0-1
/VF/VF3.dat
0-10239
Pdisk0-1
10240-20479
FILE PHYSICAL STORAGE POSITION INFO.
1001
1002
1021
783
784
785
786
FILE SYSTEM NAME
FILE PATH NAME
MIGRATION FILE BLOCK NUMBER
MIGRATION DESTINATION PHYSICAL STORAGE DEVICE NAME
MIGRATION DESTINATION PHYSICAL BLOCK NUMBER
DIFFERENCE MANAGEMENT INFO.
COPY POIN-TER
FS0-1
/data1.dat
8192-10239
Pdisk0-1
38912-40959
0 1 ··· 0
9840
FS0-2
/dataA.dat
0-8191
Pdisk0-1
30720-38911
0 0 ··· 1
1709
FILE DATA MIGRATION MANAGEMENT INFO.
FILE STORAGE MANAGEMENT INFO.
511c
36c

FIG.34

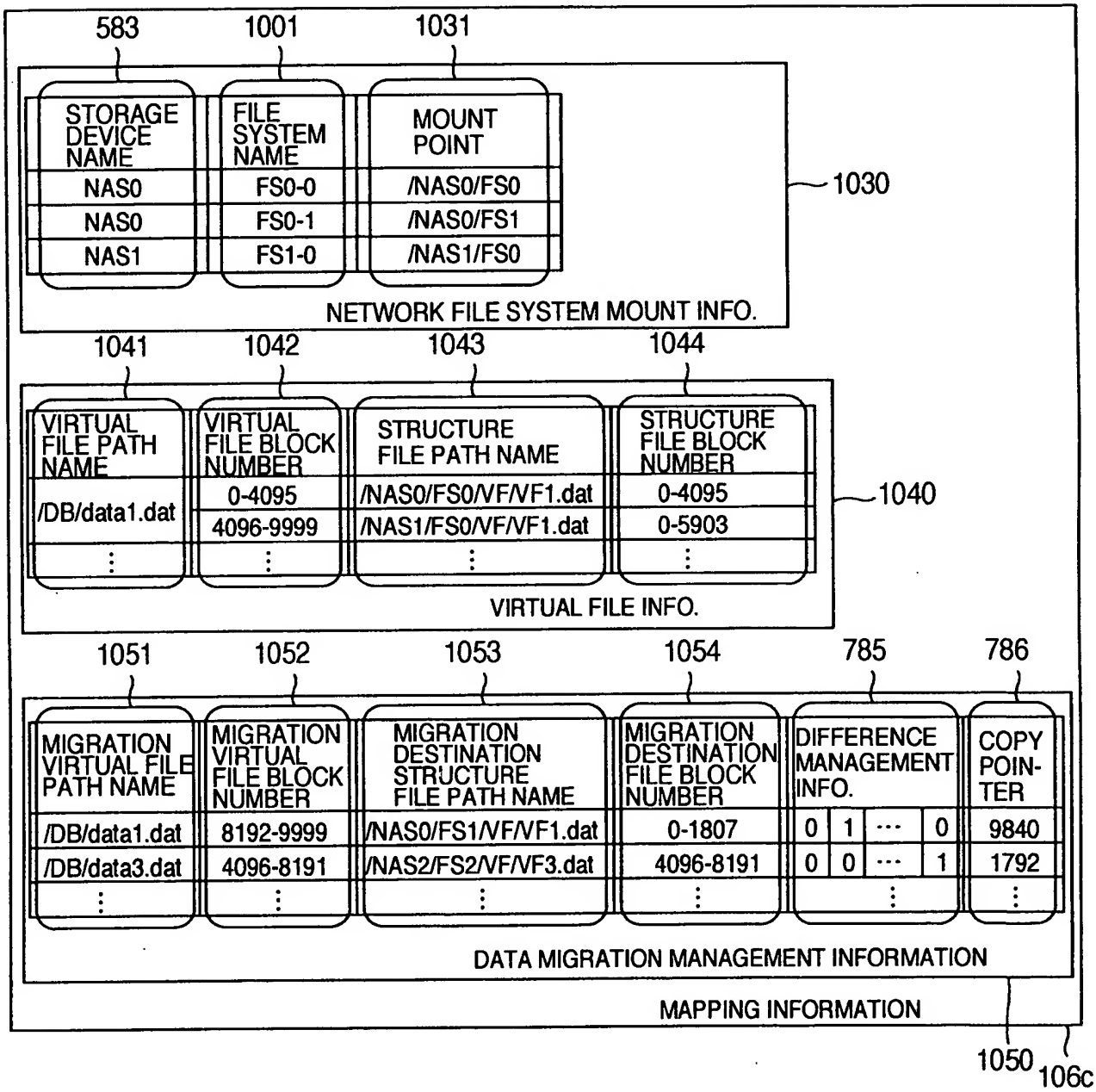

583
1001
1031
STORAGE DEVICE NAME
FILE SYSTEM NAME
MOUNT POINT
NAS0
FS0-0
/NAS0/FS0
NAS0
FS0-1
/NAS0/FS1
NAS1
FS1-0
/NAS1/FS0
NETWORK FILE SYSTEM MOUNT INFO.
1030
1041
1042
1043
1044
VIRTUAL FILE PATH NAME
VIRTUAL FILE BLOCK NUMBER
STRUCTURE FILE PATH NAME
STRUCTURE FILE BLOCK NUMBER
/DB/data1.dat
0-4095
/NAS0/FS0/VF/VF1.dat
0-4095
4096-9999
/NAS1/FS0/VF/VF1.dat
0-5903
VIRTUAL FILE INFO.
1040
1051
1052
1053
1054
785
786
MIGRATION VIRTUAL FILE PATH NAME
MIGRATION VIRTUAL FILE BLOCK NUMBER
MIGRATION DESTINATION STRUCTURE FILE PATH NAME
MIGRATION DESTINATION FILE BLOCK NUMBER
DIFFERENCE MANAGEMENT INFO.
COPY POIN-TER
/DB/data1.dat
8192-9999
/NAS0/FS1/VF/VF1.dat
0-1807
0 1 ··· 0
9840
/DB/data3.dat
4096-8191
/NAS2/FS2/VF/VF3.dat
4096-8191
0 0 ··· 1
1792
DATA MIGRATION MANAGEMENT INFORMATION
MAPPING INFORMATION
1050
106c

FIG.35

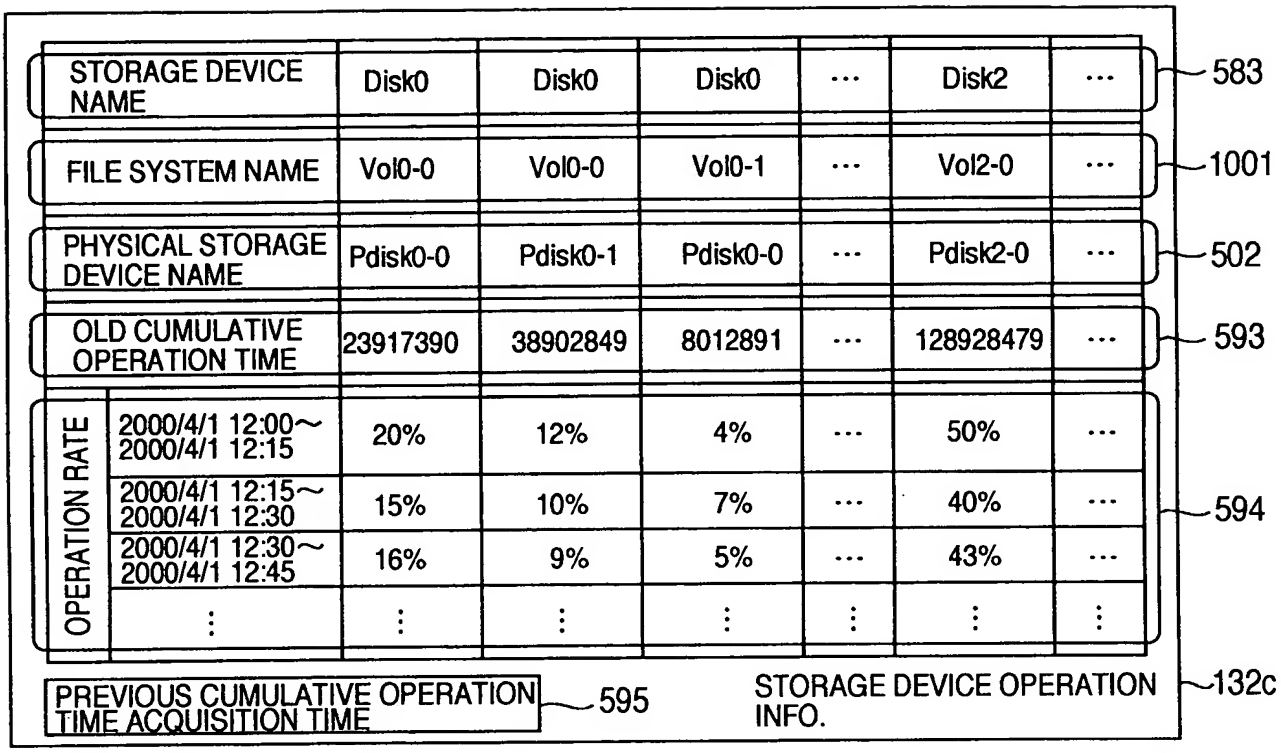

STORAGE DEVICE NAME
Disk0
Disk0
Disk0
Disk2
583
FILE SYSTEM NAME
Vol0-0
Vol0-0
Vol0-1
Vol2-0
1001
PHYSICAL STORAGE DEVICE NAME
Pdisk0-0
Pdisk0-1
Pdisk0-0
Pdisk2-0
502
OLD CUMULATIVE OPERATION TIME
23917390
38902849
8012891
128928479
593
OPERATION RATE
2000/4/1 12:00～ 2000/4/1 12:15
20%
12%
4%
50%
2000/4/1 12:15～ 2000/4/1 12:30
15%
10%
7%
40%
2000/4/1 12:30～ 2000/4/1 12:45
16%
9%
5%
43%
594
PREVIOUS CUMULATIVE OPERATION TIME ACQUISITION TIME
595
STORAGE DEVICE OPERATION INFO.
132c

FIG.36

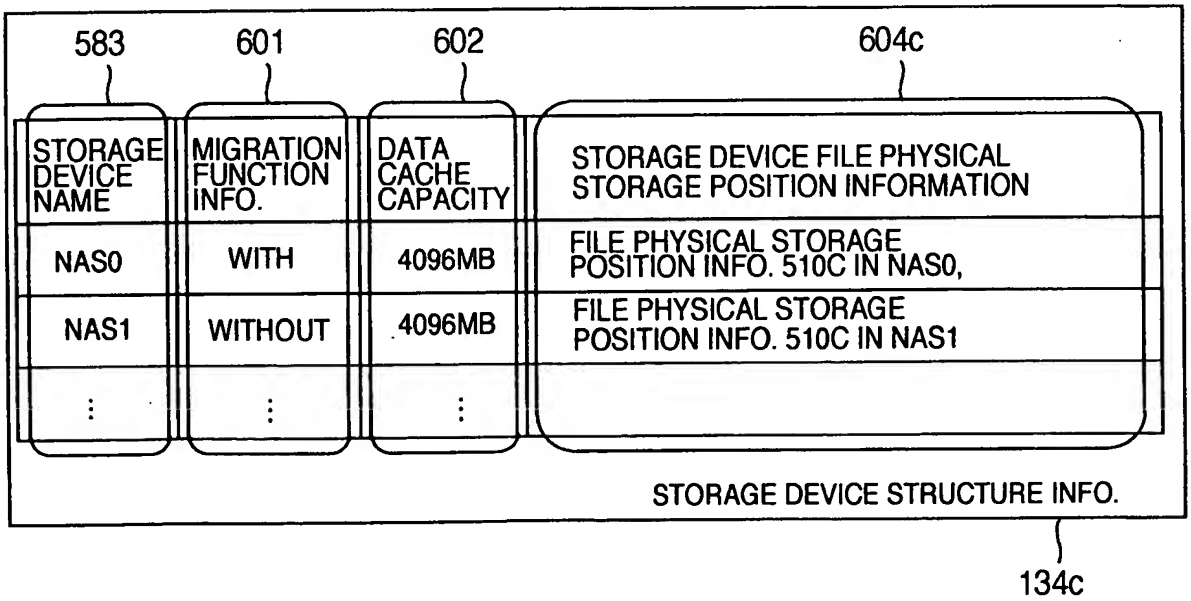

583
601
602
604c
STORAGE DEVICE NAME
MIGRATION FUNCTION INFO.
DATA CACHE CAPACITY
STORAGE DEVICE FILE PHYSICAL STORAGE POSITION INFORMATION
NAS0
WITH
4096MB
FILE PHYSICAL STORAGE POSITION INFO. 510C IN NAS0,
NAS1
WITHOUT
4096MB
FILE PHYSICAL STORAGE POSITION INFO. 510C IN NAS1
STORAGE DEVICE STRUCTURE INFO.
134c

FIG.37

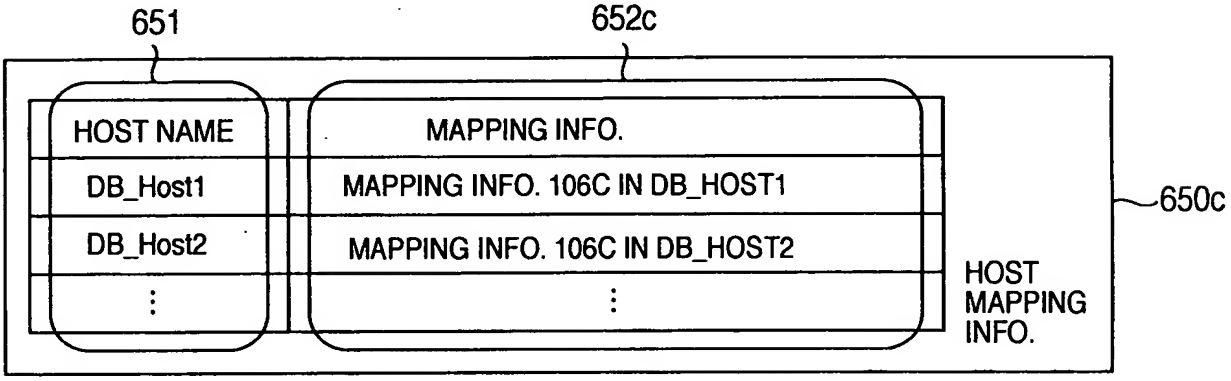

651
652c
HOST NAME
MAPPING INFO.
DB_Host1
MAPPING INFO. 106C IN DB_HOST1
DB_Host2
MAPPING INFO. 106C IN DB_HOST2
650c
HOST MAPPING INFO.

FIG.38

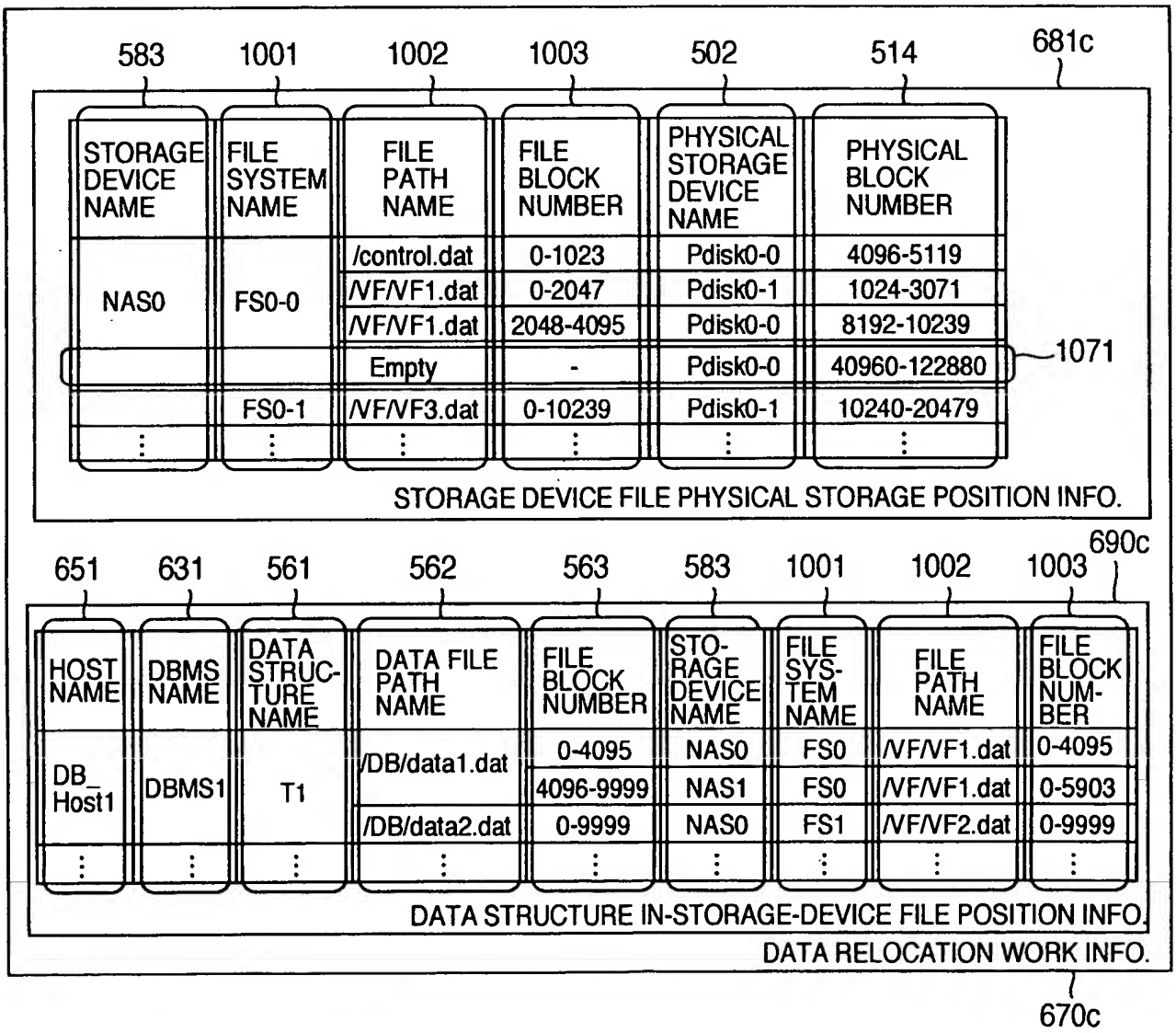
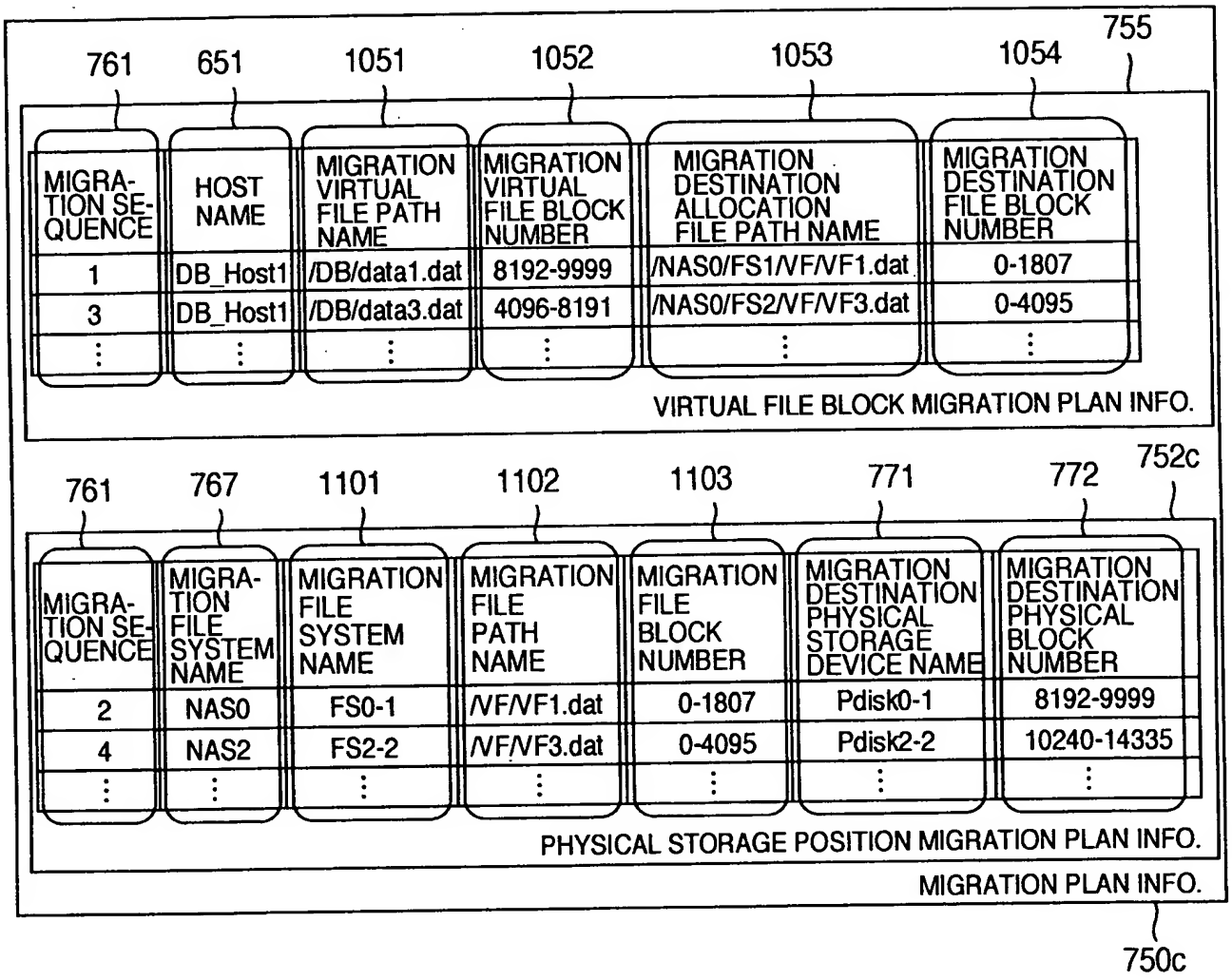

583
1001
1002
1003
502
514
681c
STORAGE DEVICE NAME
FILE SYSTEM NAME
FILE PATH NAME
FILE BLOCK NUMBER
PHYSICAL STORAGE DEVICE NAME
PHYSICAL BLOCK NUMBER
NAS0
FS0-0
/control.dat
0-1023
Pdisk0-0
4096-5119
/VF/VF1.dat
0-2047
Pdisk0-1
1024-3071
/VF/VF1.dat
2048-4095
Pdisk0-0
8192-10239
Empty
-
Pdisk0-0
40960-122880
1071
FS0-1
/VF/VF3.dat
0-10239
Pdisk0-1
10240-20479
STORAGE DEVICE FILE PHYSICAL STORAGE POSITION INFO.
651
631
561
562
563
583
1001
1002
1003
690c
HOST NAME
DBMS NAME
DATA STRUC-TURE NAME
DATA FILE PATH NAME
FILE BLOCK NUMBER
STO-RAGE DEVICE NAME
FILE SYS-TEM NAME
FILE PATH NAME
FILE BLOCK NUM-BER
DB_ Host1
DBMS1
T1
/DB/data1.dat
0-4095
NAS0
FS0
/VF/VF1.dat
0-4095
4096-9999
NAS1
FS0
/VF/VF1.dat
0-5903
/DB/data2.dat
0-9999
NAS0
FS1
/VF/VF2.dat
0-9999
DATA STRUCTURE IN-STORAGE-DEVICE FILE POSITION INFO.
DATA RELOCATION WORK INFO.
670c

FIG.39


755
761
651
1051
1052
1053
1054
MIGRATION SEQUENCE
HOST NAME
MIGRATION VIRTUAL FILE PATH NAME
MIGRATION VIRTUAL FILE BLOCK NUMBER
MIGRATION DESTINATION ALLOCATION FILE PATH NAME
MIGRATION DESTINATION FILE BLOCK NUMBER
1
DB_Host1
/DB/data1.dat
8192-9999
/NAS0/FS1/VF/VF1.dat
0-1807
3
DB_Host1
/DB/data3.dat
4096-8191
/NAS0/FS2/VF/VF3.dat
0-4095
VIRTUAL FILE BLOCK MIGRATION PLAN INFO.
752c
761
767
1101
1102
1103
771
772
MIGRATION SEQUENCE
MIGRATION FILE SYSTEM NAME
MIGRATION FILE SYSTEM NAME
MIGRATION FILE PATH NAME
MIGRATION FILE BLOCK NUMBER
MIGRATION DESTINATION PHYSICAL STORAGE DEVICE NAME
MIGRATION DESTINATION PHYSICAL BLOCK NUMBER
2
NAS0
FS0-1
/VF/VF1.dat
0-1807
Pdisk0-1
8192-9999
4
NAS2
FS2-2
/VF/VF3.dat
0-4095
Pdisk2-2
10240-14335
PHYSICAL STORAGE POSITION MIGRATION PLAN INFO.
MIGRATION PLAN INFO.
750c